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A Financial Analysis Concerning Conventional Crude Oil and Natural Gas Exploration, Development, and Production Activities in the United States

1959-1978

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Chapter I

Introduction and Summary

INTRODUCTION

The crude oil and natural gas field activity sector is the largest of all manufacturing or nonmanufacturing industry groupings in the United States — both in terms of net income and net investment (the single exception would be the larger investment in the public utility sector).

A complete financial analysis of the United States crude oil and natural gas field activities has apparently never been published by any body which would have been expected to have researched the subject — such as U. S. government agencies, academic or research institutions, financial establishments, trade or professional associations, private industry, or others expert in the field. A reasonably comprehensive financial analysis of U. S. crude oil and natural gas field activities is believed possible based upon publically available data, some data not generally available to the public, and supplemented by special studies or interpretations required in the analysis.

The industry data system utilized for this financial analysis includes periodic reports from the U. S. Bureau of Mines (USBM), Department of Energy (DOE), Geological Survey (USGS), National Science Foundation, and Bureau of Census. Industry trade or professional association reports include those from the American Petroleum Institute (API), American Gas Association (AGA), American Association of Petroleum Geologists (AAPG), and the Joint Association Surveys (JAS). Financial institution reports from Chase Manhattan Bank and Citibank were utilized. Other data inputs have come from Price Waterhouse special tax studies, annual shareholders' reports of the larger companies, and studies by the staff of the Joint Congressional Committee on Taxation.

The activities covered by this financial review include related research, exploration for crude oil and natural gas, and development and production of crude oil and natural gas down to the point of custody transfer of the produced volumes from the leases into the transportation system. The review has excluded mining activities (whether for energy fuels or other substances), natural gas processing, and other activities not directly related to exploration, development, or production of crude oil and natural gas. The sales or transfers of assets between establishments within the crude oil and natural gas field sector have been ignored in the analysis.

Many of the companies or establishments engaged in oil and gas field activities are also engaged in other petroleum activities such as transportation, refining, wholesale or retail marketing, chemicals, mining, or other diversifications not related to energy. However, this specific analysis of U.S. crude oil and natural gas field activities is possible through the data reporting systems which have allocated most direct and indirect expenditures to the oil and gas field activity function and which have valued the crude oil and natural gas production streams at the point of custody transfer. This analysis, therefore, generally develops revenues, expenses,

taxes, write-offs, net income, and investment data as if the oil and gas field operations were carried out by separate establishments on a corporate basis.

The financial review covers the twenty year period 1959-1978 and has been subdivided into five parts.

The first portion of the review pertains to operating cash incomes (OCI) which are the pre-tax funds generated from production operations. The revenue amounts are based upon crude oil and natural gas production volumes and unit well head prices. The various production expenses for royalty, severance and property taxes, operations, and overhead are also considered in this portion. Operating cash income is discussed in Chapter II.

The second portion of the review assesses the reinvestment program[1] which is directed toward the generation of future incomes. A portion of the reinvestment program is charged directly to income as expense and includes research, the exploration operating program (including exploratory dry holes) and overhead expenses associated with the development program. The remaining portions of the reinvestment program are capitalized and recovered through write-off provisions. These capitalized expenditures include lease acquisitions, productive drilling, development dry holes, lease equipment, improved recovery programs and other. The reinvestment programs result in subsequent additions to hydrocarbon ultimate recovery, and are discussed in Chapters III and V.

Income taxes, the third portion of the study, are estimated in Chapter IV. Completion of the income tax estimates then permits the analysis of cash flow which is discussed in Chapter VI.

The fourth portion of the analysis concerns write-offs and net income and is discussed in Chapter VII. In this review, the activities are accounted for according to the "successful efforts" method of accounting. The capitalized costs of fixed equipment (including development dry holes) and productive leaseholds are provided for on a unit of production (UOP) basis. Nonproductive leaseholds are amortized over their holding periods. Other portions of the reinvestment program are charged directly against income as mentioned before.

The net income return on net investment is discussed in Chapter VIII.

In the public policy area, new problems or controversies continue to emerge and old problems seem to remain concerning oil and gas field activities. These problems are principally in the areas of access to energy resources under government control, environmental considerations, price controls, and taxation. It is not the purpose of this financial analysis to take a position on any of these issues. Instead, it is believed that the quality of the public debate on most of these issues would be enhanced if a better understanding of the industry were possessed by those involved. It is hoped that this review will contribute in some measure to that better understanding.

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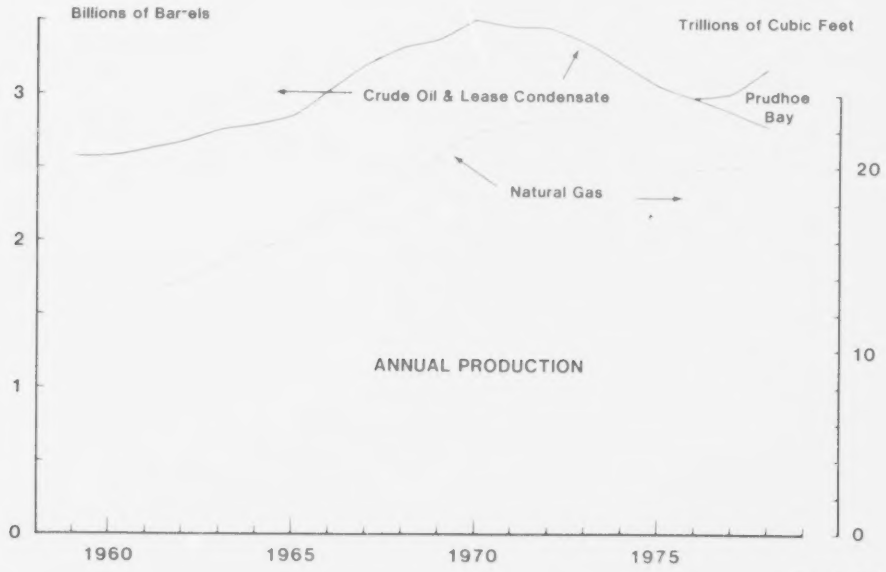
[1] The term "reinvestment" was chosen in preference to "investment" to emphasize the necessity for an oil and gas producing establishment to reinvest continuously a high fraction of its internal cash generation in order to perpetuate itself.

SUMMARY

Operating Cash Income

It is convenient to divide the twenty year review period into the first ten years 1959-1968, the next five years 1969-1973, and the post-Arab embargo five year period 1974-1978. Most unit operating indexes, as well as unit wellhead values, remained somewhat steady or increased slowly during the first ten years; rose moderately during the next five years; and then increased rapidly during the most recent five years.

Crude oil production volume rates increased from 7.1 million barrels daily in 1959 to 9.6 million barrels daily during 1970 and then declined to 8.1 million barrels per day during 1976. Since 1976, crude oil production has again risen to 8.7 million barrels per day by 1978, because of Prudhoe Bay, as shown by Graph 1. Natural gas production increased from 12.0 trillion cubic feet during 1959 to 22.6 trillion cubic feet during 1973; declined to 21.6 trillion cubic feet during 1974; and has remained at the 20 trillion cubic feet annual level during the last four years. Natural gas production rates are also charted on Graph 1.



Graph I-1

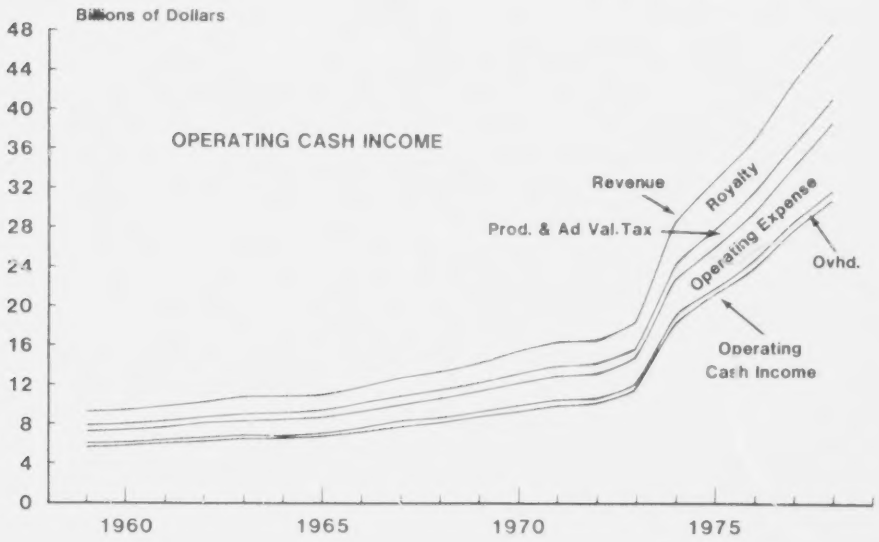
The above trends have impacted upon operating cash income over the twenty year review period as summarized below:

OPERATING CASH INCOME SUMMARY 1959-1978

		1959	*1968*	*1973*	*1978*
Crude Oil Production	MMB/D	7.1	9.1	9.2	8.7
Natural Gas Production	TCF/Y	12.0	19.3	22.6	20.0
Crude Oil Price	$/B	2.90	2.94	3.89	8.96
Natural Gas Price	$/MCF	.13	.16	.22	.91
Operating Cost	$/B.C.O.E.	.31	.31	.38	.97
Production Overhead	$/B.C.O.E.	.06	.05	.07	.16
Operating Cash Income	$/B.C.O.E.	1.20	1.21	1.55	4.58
Operating Cash Income	Billions $	5.7	8.2	11.4	30.9

One barrel of crude oil equivalent (C.O.E.) equals 5.8 million BTU's.

The operating cash income details are also charted on Graph 2.



Graph 2-2

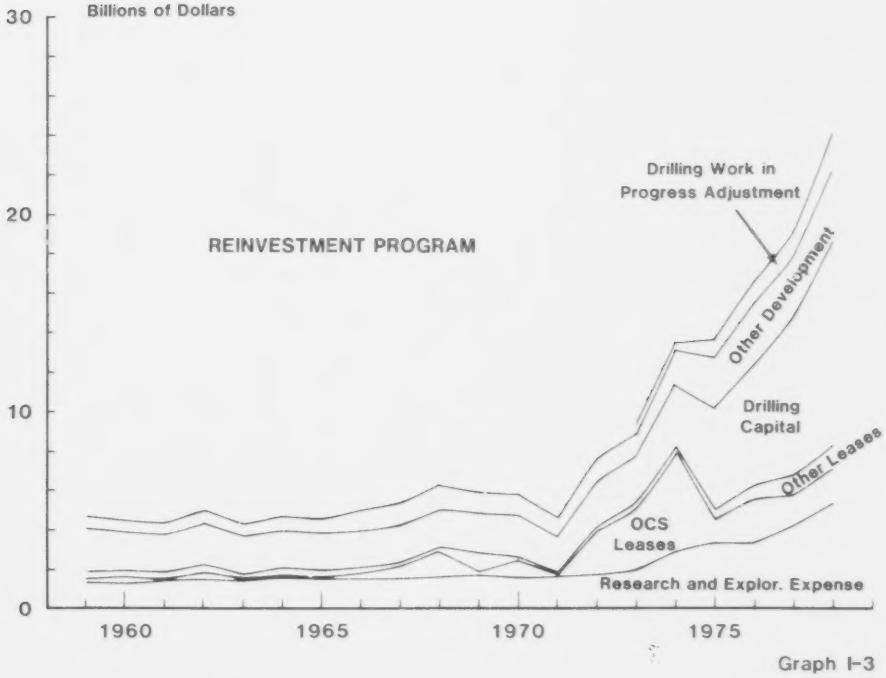
Reinvestment Program

Reinvestment, directed toward future energy supplies, has varied between $4.3 and $5.0 billion and has averaged $4.7 billion annually during the first eight years 1959-1966. The reinvestment level almost doubled during the next seven years and reached $9.2 billion by 1973. During the last five years, the reinvestment program increased rapidly, reaching $24.1 billion by 1978. Reinvestment has totaled $169 billion during the twenty year review period with slightly over half of the funds being invested during the most recent five years. Expenditures for outer continental shelf (OCS)

lease acquisitions have become more important during the last ten years and drilling expenditures have increased relatively during the most recent five years. The relative importance of the expensed portion of the reinvestment program has declined across the review period. These trends are summarized below and on Graph 3:

REINVESTMENT PROGRAM 1959-1978

		1959-68	*1969-73*	*1974-78*
Annual Reinvestment Program (billion $)		4.9	6.7	17.4
Portions of Total Reinvestment				
Capital Expenditures	- Drilling	.392	.322	.435
	- OCS Leases	.062	.194	.134
	- Other Leases	.077	.053	.043
	- Other	.132	.140	.146
	Sub Total	.663	.709	.758
Expensed Program	- Research	.017	.018	.011
	- Exploration Operating	.285	.239	.209
	- Development Overhead	.035	.034	.022
	Sub Total	.337	.291	.242



Graph I-3

Reinvestment programs have generally kept pace with the increase in pre-tax funds made available from production operations. Reinvestment

programs consumed 75 percent of operating cash income during 1959-64 and 69 percent during 1965-77. The reinvestment portion increased to 78 percent during 1978.

As indicated above, the capitalized portion of the reinvestment program has increased from two thirds to three quarters across the review period. Because of increased activity, cost inflation, maturity and increasing complexity, write-off provisions have generally been considerably less than capital expenditure requirements and this short fall has become more pronounced since 1971. Write-offs have covered, on average, 76 percent of capital expenditure requirements during 1959-71 and 50 percent since 1971.

Annual additions to hydrocarbon recorded ultimate recovery have averaged 6.0 billion barrels of crude oil equivalent during 1959-71. Since 1971, additions have been at a lower level, though they have increased from 3.8 billion barrels C.O.E. during 1972 to 5.5 billion barrels during 1978 (and to 6.9 billion barrels during 1979).

When expressed as $ per barrel of C.O.E. additions to ultimate recovery, the reinvestment program has ranged between $0.63 and $1.38 and has averaged $0.84 over the 1959-71 period. Since 1971, this index has increased from $0.87 to $4.07 per barrel C.O.E. by 1978.

Income Taxes and Cash Flow

Effective income tax rates have generally increased since 1965; the increase is principally related to an improvement in operating cash income per barrel C.O.E. from lowest levels during 1965-66, the reduction in allowable depletion percentage after 1969, and the virtual elimination of the percentage depletion provision for larger companies after 1974.

Effective income tax rates are expressed as the ratio between income taxes and net income before income tax. This rate averaged 2 percent during 1959-65. The rate increased from 0 percent during 1965 to 12 percent during 1969 as operating cash income increased from $1.18 to $1.25 per barrel C.O.E. The effective tax rate averaged 28 percent during 1970-74 when the maximum allowable depletion rate was 22 percent and while OCI per barrel C.O.E. was increasing from $1.25 in 1969 to $2.66 in 1974. The effective tax rate averaged 39 percent during 1975-78 after the virtual elimination of the percentage depletion provision and while OCI rose further to $4.58 per barrel of C.O.E. in 1978.

Net cash flow[1] is a function of production volumes, unit operating cash incomes, reinvestment ratios, and income taxes. Net cash flow amounted to $25.6 billion during 1959-71 which exceeded the dividend allocations of $16.3 billion and resulted in $9.3 billion of surplus cash. During 1972-78, net cash flow has amounted to $12.4 billion which is less than the dividend allocation of $15.8 billion — thus creating a cash shortfall of $3.4 billion during the last seven years. Following the general pattern of the larger, predominately domestic oil companies, the dividend allocation was reduced

[1] Net cash flow may be defined as total revenue less all expenses, taxes, capital expenditures, and additions to working capital.

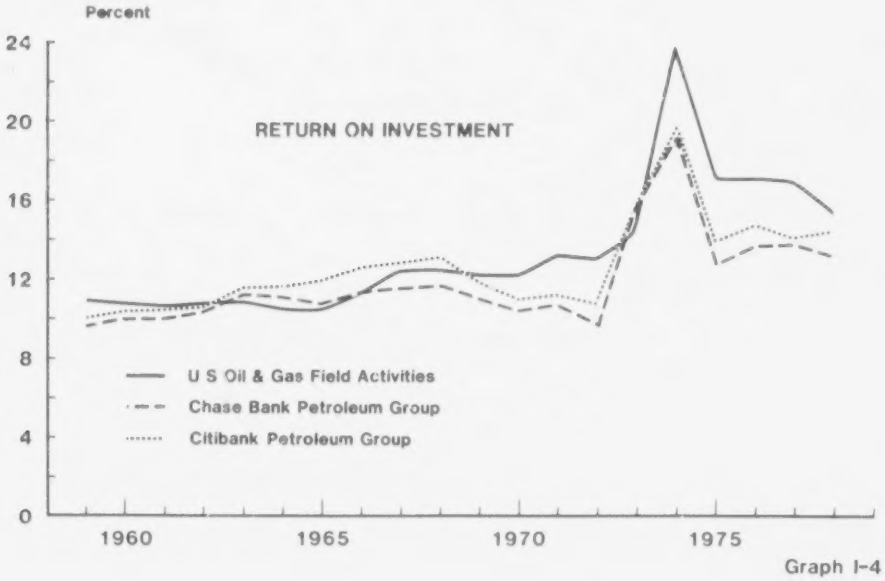
from 50 percent to 40 percent of net income during 1973 and further to 30 percent during 1974 and thereafter.

Write-Offs and Net Income

Write-offs and deferred taxes increased from $2.4 billion during 1959 to $3.5 billion during 1973; they then increased more rapidly to $11.0 billion during 1978. Net income thus improved from $1.8 billion during 1959 to $3.6 billion during 1971-72 and then more rapidly to $9.5 billion during 1978.

Return On Investment

Net income from U. S. oil and gas field activities, when expressed as a percent of net investment on Graph 4, was in the 10-11 percent range during 1959-66; in the 12-13 percent range during 1967-72; 14 percent during 1973; 24 percent during 1974; and in the 15-17 percent range thereafter. These rates are generally higher (and especially so during 1974) than petroleum industry group rates as reported by Chase Manhattan Bank and Citibank, except during 1963-1967 (also charted on Graph 4).

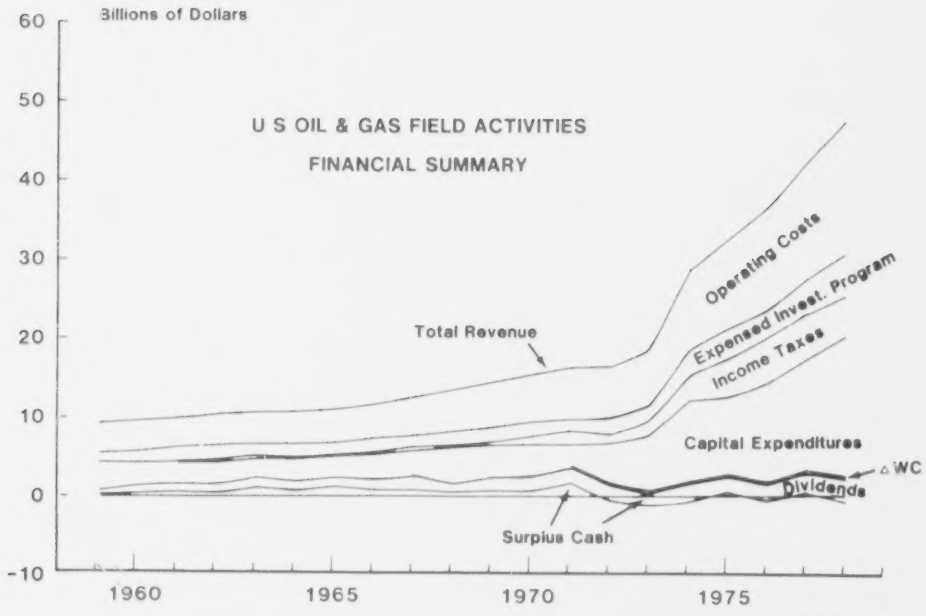


Graph I-4

Financial Summary

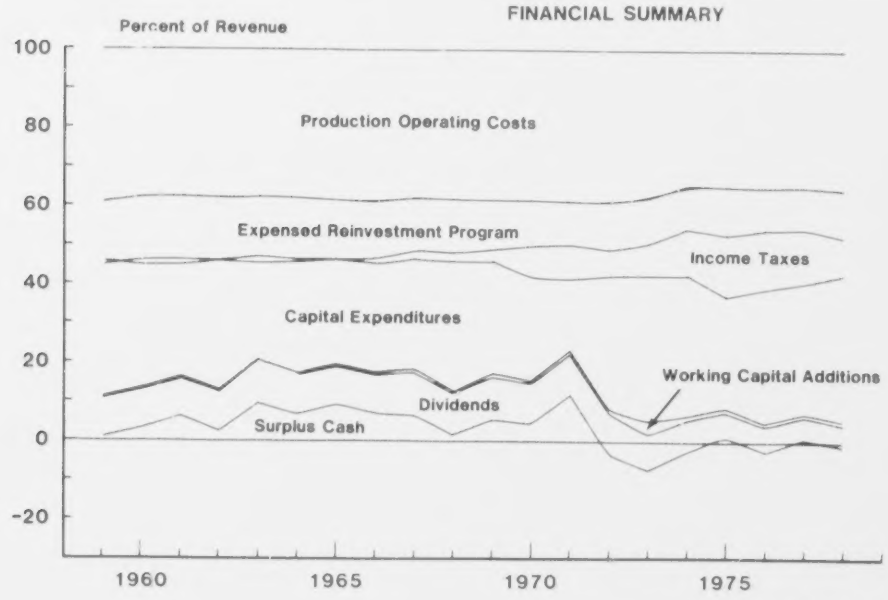
Graph 5 shows the financial summary of the U. S. oil and gas field activities. The uppermost line is the total oil and gas field revenue. As shown by the graph, various expenditures are progressively subtracted, yielding financial measures such as operating cash income, cash income before and after tax, net cash flow, and surplus cash. Graph 6 shows the financial information from Graph 5, expressed as percents of revenue.

Graph 6 shows the impact on net cash flow before dividend allocation of the relative increase in income taxes since 1969 and the relative increases in



Graph I-5

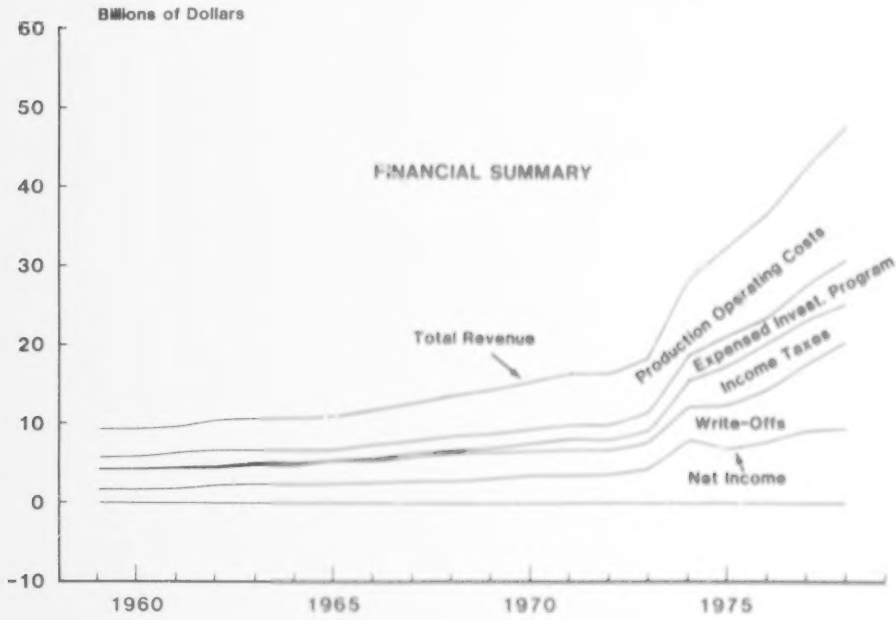
capital expenditures since 1971, which have been caused by increased physical activity, cost inflation, maturity and increased complexity. These recent changes cause the various usual methods of expressing investment



Graph I-6

indexes or ratios to become less meaningful when referred to alone. The reduction in net cash flow during the last seven years and the cash deficits remaining after dividends indicate that the oil and gas field activity sector has not operated recently on the self sustaining basis which had characterized these activities prior to 1972. This is probably because after 1971 Industry's perception of the future investment climate was more favorable than that held prior to 1972. During the earlier era, well head prices of crude oil and natural gas were rising less rapidly than customary measures of inflation and Industry apparently elected to liquidate slowly (withdraw from) the domestic oil and gas field activity sector. More recently, the opposite situation has prevailed and Industry has chosen not only to reduce dividend pay-out ratios but also to reinvest at rates which generally exceed internal cash generation.

Graph 7 is an alternate financial summary on a write-off and net income — rather than net cash flow-basis.



Graph I-7

Operating Cash Income

Operating cash income is defined as the value of production from oil and gas field activities less expenses (but not capital expenditures) related to production.

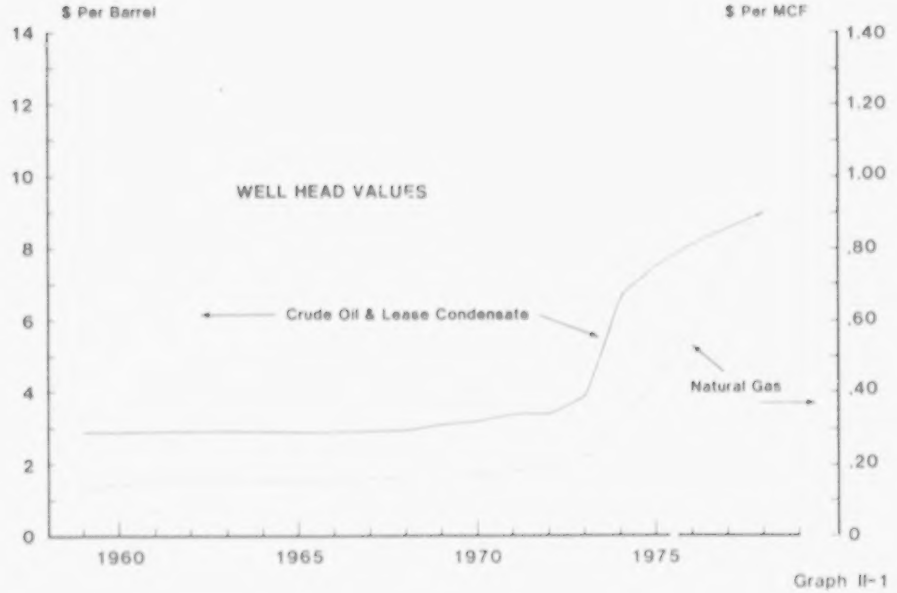
Annual production volumes, unit wellhead values and value of crude oil, lease condensate, and natural gas production are shown on Table 1 which is based upon U.S. Bureau of Mines and Department of Energy reports. The crude oil and natural gas unit prices are also charted on Graph 1.

Production expenses for oil and gas field activities are shown in Table 2 which also summarizes the calculation of operating cash income. The Table 2 data, except for value of production and royalty, are based upon Joint Association Surveys through 1975 and Bureau of Census reports after 1975. Census data are also available for 1973-74-75 and Table 3 shows the comparisons of JAS and Census data during these years for which both data series are available.

TABLE II-1

U.S. INDUSTRY
VALUE OF CRUDE OIL AND NATURAL GAS PRODUCTION

	Crude Oil and Lease Condensate			*Natural Gas*		
Year	*Prod MMB*	*Unit Value $/B*	*Value MM$*	*Marketed Prod BCF*	*Unit Value $/MCF*	*Value MM$*
1959	2,575	2.90	7,473	12,046	.129	1,557
1960	2,575	2.88	7,420	12,771	.140	1,790
1961	2,622	2.89	7,566	13,182	.151	1,996
1962	2,676	2.90	7,774	13,801	.155	2,145
1963	2,753	2.89	7,966	14,667	.158	2,328
1964	2,787	2.88	8,017	15,462	.154	2,388
1965	2,849	2.86	8,158	16,040	.156	2,495
1966	3,028	2.88	8,726	17,207	.157	2,703
1967	3,216	2.92	9,376	18,171	.160	2,899
1968	3,329	2.94	9,795	19,322	.164	3,169
1969	3,372	3.09	10,427	20,698	.167	3,456
1970	3,517	3.18	11,174	21,921	.171	3,746
1971	3,454	3.39	11,693	22,493	.182	4,085
1972	3,455	3.39	11,707	22,532	.186	4,180
1973	3,361	3.89	13,058	22,648	.216	4,894
1974	3,203	6.74	21,581	21,601	.304	6,572
1975	3,057	7.56	23,116	20,109	.445	8,945
1976	2,976	8.14	24,230	19,952	.580	11,572
1977	3,009	8.57	25,791	20,025	.790	15,826
1978	3,178	8.96	28,478	19,974	.905	18,085



Graph II-1

TABLE II-2

U.S. INDUSTRY
OPERATING CASH INCOME – FROM CRUDE OIL AND NATURAL GAS PRODUCTION ACTIVITIES – MMs

Year	Value of Prod.	Other Income	Royalty	Ad Val Tax	Prod. Tax	Operating Cost	G&A Overhead	Oper. Cash Income	Operating Cash Income as Portion of Total Revenue
1959	9,030	254	1,355	192	316	1,450	285	5,686	.612
1960	9,210	261	1,382	199	339	1,390	273	5,888	.622
1961	9,562	284	1,434	195	346	1,455	294	6,122	.622
1962	9,919	293	1,488	202	354	1,535	307	6,326	.619
1963	10,294	323	1,544	198	373	1,581	302	6,619	.623
1964	10,405	317	1,561	204	393	1,613	296	6,655	.621
1965	10,653	312	1,598	212	400	1,685	313	6,757	.616
1966	11,429	333	1,714	212	430	1,895	310	7,201	.612
1967	12,275	366	1,842	248	464	1,933	303	7,851	.621
1968	12,964	378	1,945	259	499	2,094	340	8,205	.615
1969	13,883	398	2,082	271	525	2,189	369	8,845	.619
1970	14,920	378	2,238	294	563	2,379	416	9,408	.615
1971	15,778	383	2,367	295	587	2,504	465	9,943	.615
1972	15,887	374	2,383	269	613	2,563	467	9,966	.613
1973	17,952	415	2,693	275	683	2,792	485	11,439	.623
1974	28,154	550	4,223	384	1,209	3,508	584	18,796	.655
1975	32,061	624	4,809	489	1,329	4,246	619	21,193	.648
1976	35,802	971	5,370	1,898		4,877	866	23,762	.646
1977	41,617	1,133	6,243	2,100		5,729	906	27,772	.650
1978	46,563	1,282	6,984	2,380		6,560	1,071	30,850	.645

(1) Assumed as 65% of Production Department overhead during 1959-1965, according to JAS allocations during 1966-1975.

TABLE II-3

U.S. INDUSTRY
OPERATING CASH INCOME DATA
COMPARISONS BETWEEN JAS AND CENSUS
MM$

	1973		1974		1975	
	JAS	CENSUS	JAS	CENSUS	JAS	CENSUS
Other Revenue	415	505	550	727	624	854
Ad Valorem Tax	275		384		489	
Production Tax	683		1,209		1,329	
SUBTOTAL	958	925	1,593	1,534	1,818	1,746
Production Operating Cost		2,594		3,246		3,953
Other Indirect Expense		194		252		358
SUBTOTAL	2,792	2,788	3,508	3,498	4,246	4,311
Overhead	485	497	584	601	619	769
TOTAL PRODUCTION COSTS	4,235	4,210	5,685	5,633	6,683	6,826

TABLE II-4

U.S. INDUSTRY
OPERATING CASH INCOME MISCELLANEOUS INDEXES

Year	Prod Wells at Jan 1 (M)	Total Prod. MMB C.O.E.	Crude Oil & Lse. Cond as Portion of Total Production	Ad Val. & Prod. Tax as a Portion of Oil & Gas Rev. After Roy.	Operating Cost $ BBL C.O.E.	Operating Cost M$ Year Per Well	Production G&A Overhead $ BBL C.O.E.	Production G&A Overhead $ Year per Well	Oper Cash Income $ BBl C.O.E.
1959	655	4,724	.545	.066	.307	2.2	.060	435	1.204
1960	666	4,854	.530	.059	.286	2.1	.056	410	1.213
1961	682	4,974	.527	.067	.293	2.1	.059	431	1.231
1962	692	5,139	.521	.066	.299	2.2	.060	444	1.231
1963	697	5,370	.513	.065	.294	2.3	.056	433	1.233
1964	692	5,546	.503	.068	.291	2.3	.053	428	1.209
1965	691	5,711	.499	.068	.295	2.4	.055	453	1.183
1966	701	6,098	.497	.066	.311	2.7	.051	442	1.181
1967	696	6,458	.498	.068	.299	2.8	.047	435	1.216
1968	678	6,777	.491	.069	.309	3.1	.050	501	1.211
1969	668	7,065	.477	.067	.310	3.3	.052	552	1.252
1970	657	7,429	.473	.068	.320	3.6	.056	633	1.266
1971	649	7,468	.463	.066	.335	3.9	.062	716	1.331
1972	638	7,476	.462	.065	.343	4.0	.062	732	1.333
1973	630	7,402	.454	.063	.377	4.4	.066	770	1.545
1974	622	7,057	.454	.067	.497	5.6	.083	929	2.663
1975	624	6,645	.460	.067	.639	6.8	.093	992	3.189
1976	631	6,537	.455	.062	.746	7.7	.132	1,372	3.635
1977	637	6,583	.457	.059	.870	9.0	.138	1,422	4.219
1978	655	6,742	.471	.060	.973	10.0	.159	1,635	4.576

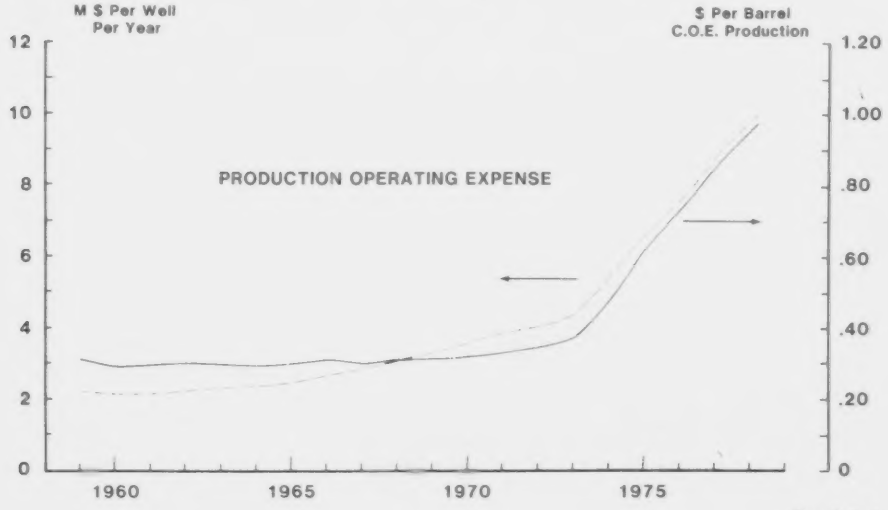
NOTE: 1 Barrel C.O.E. = 5.8 Million BTU's.

Crude oil and natural gas royalty data, on an industry basis, are not available. For most years of the review period, it was possible to work up gross and net (after deducting royalty) crude oil production volumes for large, medium, and small companies which generally accounted for about two-thirds of the United States total production. The net/gross crude oil production volume ratios appeared fairly steady at 0.85 without any tendency for variation with company size or time. It has been assumed that the 0.85 ratios can also be applied to natural gas volumes and further be applicable to revenue amounts.

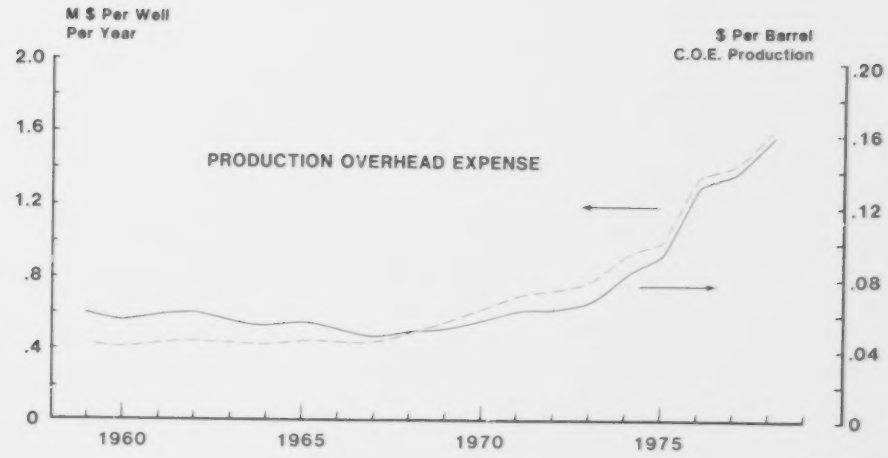
Table 4 lists some indexes relative to crude oil and natural gas production activities. Crude oil and lease condensate production, when expressed as a portion of total hydrocarbon energy production, has declined from 55 percent during 1959 to 46 percent during 1971. Since 1971 this share has remained in the 46 percent range. Production and ad valorem taxes are expressed as a portion of oil and gas value after royalty. This index has generally remained in the 6-7 percent range.

Production operating costs, expressed as $ per barrel of crude oil equivalent production, are shown on Graph 2. This index generally remained in the $0.29 to $0.31 per barrel C.O.E. range for the first ten years; increased slowly during the next five years from $.31 per barrel during 1968 to $0.38 per barrel during 1973; and then rose rapidly to $0.97 per barrel by 1978. These same production operating costs, when expressed as $ per well per year, are also plotted on Graph 2. They doubled from $2,200 per well per year in 1959 to $4,400 per well per year in 1973 and then increased more rapidly to $10,900 per well per year during 1978.

As shown on Graph 3, production overhead amounted to 5-6¢ per barrel of C.O.E. during 1959-1973, and then increased to 16¢ per barrel of C.O.E. by 1978. Production overhead increased from $400 per well per year in 1959 to $800 by 1973 and then to $1600 per well per year during 1978.

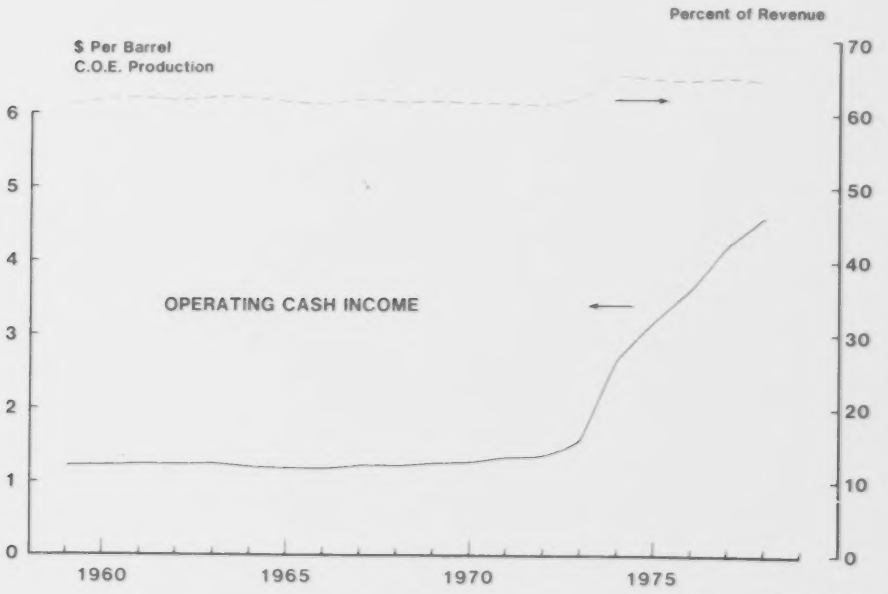


Graph II-2



Graph II-3

The trend of annual operating cash income per barrel of crude oil equivalent production is shown on Graph 4. This index remained in the $1.18 to $1.23 per barrel range during the first ten years 1959-1968. During the next five years the index increased from $1.21 to $1.55 per barrel in 1973; and then the index increased more rapidly to $4.58 per barrel C.O.E. by 1978. Operating cash income, expressed as a percent of revenue, is also shown on Graph 4. This ratio remained in the 61-62 percent range during 1959-1973 and in the 64-65 percent range during 1974-1978.



Graph II-4

Cash Income Before Tax

Cash income before tax is defined as operating cash income less that part of the reinvestment program which is charged to income as expense. These noncapitalized portions of the reinvestment program are research and development expenses, the exploration operating expenses and general and administrative overhead expenses associated with the development program.

Table 1 shows the expensed exploration operating program. The nondrilling parts of exploration operating expense are JAS data through 1975 and Census data after 1975. Table 2 compares these JAS and Census data for years 1973-74-75. The exploration dry hole costs are also included on Table 1. For this analysis, total dry hole costs have been apportioned between exploration and development based upon a long term regression analysis utilizing total drilling costs for each function and the total of dry hole costs for both functions (see Chapter IV, Chapter V, and Chapter VII).

TABLE III-1

U.S. INDUSTRY
EXPLORATION OPERATING EXPENSES
MM$

Year	Explor. Dry Holes[1]	Geol. & Geoph.	Land Dept. Leasing & Scouting	Rentals	Test Well Cont.	Other Incl. Direct Ovhd.	G&A Ovhd.	Total
1959	462	320	(2)	193		124	183	1,282
1960	450	277	104	193		71	197	1,292
1961	456	280	115	189		65	219	1,324
1962	508	299	108	197		58	213	1,383
1963	494	300	117	193		69	200	1,373
1964	545	336	100	177		72	215	1,445
1965	545	355	102	166		61	207	1,436
1966	499	378	70	180	28	128	195	1,478
1967	479	392	86	140	34	122	206	1,459
1968	490	373	82	179	34	136	204	1,498
1969	535	387	93	134	33	168	210	1,560
1970	503	349	98	138	30	143	189	1,450
1971	532	361	100	143	24	142	206	1,508
1972	605	372	105	142	35	147	239	1,645
1973	637	429	102	155	38	181	293	1,835
1974	1,100	640	117	186	34	231	387	2,695
1975	1,440	702	141	215	39	302	403	3,242
1976	1,495	692	126	207	22	241	405	3,188
1977	1,914	856	164	246	33	305	422	3,940
1978	2,725	1,046	164	285	25	393	489	5,127

(1) Excludes test well contributions.
(2) Included with other.
(3) Not available 1959-65.

TABLE III-2

U.S. INDUSTRY
EXPLORATION OPERATING EXPENSES
COMPARISONS BETWEEN JAS AND CENSUS
(MMS

	1973		1974		1975	
	JAS	CENSUS	JAS	CENSUS	JAS	CENSUS
Geological and Geophysical	429	400	640	568	702	653
Land Department, Leasing, and Scouting	102	77	117	91	141	113
Rentals	155	151	186	178	215	205
Test Well Contributions	38	14	34	9	39	17
Other Including Direct Overhead	181	106	231	169	302	242
General and Administrative Overhead	293	204	387	291	403	342
TOTAL	1,198	952	1,595	1,306	1,802	1,572

(1)Excludes exploration dry holes.

TABLE III-3

U.S. PETROLEUM REFINING AND EXTRACTION INDUSTRY
RESEARCH AND DEVELOPMENT EXPENDITURES
MMS

Year	Funded by Industry	Funded by Government	Total
1959	252	27	278
1960	276	20	296
1961	280	19	299
1962	289	20	310
1963	296	21	317
1964	373	20	393
1965	377	20	397
1966	351	20	371
1967	351	20	371
1968	417	20	437
1969	447	20	467
1970	493	22	515
1971	488	17	505
1972	454	15	468
1873	485	14	498
1974	603	20	622
1975	669	30	700
1976	715	52	767
1977	839	74	913
1978			

(1)National Science Foundation. Includes research, applied research, and development. Excludes quality control, product testing, market research, technical services, nontechnical activities, and exploration expense.

The totals were restated for 1964-1969 without subdivision according to source of funding. The splits shown above for1964-1969 are based upon a $20MM annual government funding level.

Table 3 shows some research and development data for the U.S. petroleum and extraction industry from National Science Foundation reports. Based upon indications as to how some important R&D programs have been subdivided, it has been assumed that 25 percent of the petroleum industry R&D amounts have been in the oil and gas field activity classification.

Table 4 summarizes the calculation of cash income before tax. Cash income before tax has increased from $4.2 billion during 1959 to $6.4 billion during 1968; increased more rapidly to $9.2 billion during 1973; and then very rapidly to $25 billion by 1978.

TABLE III-4

U.S. INDUSTRY

CRUDE OIL AND NATURAL GAS CASH INCOME BEFORE TAX
MM$

Year	Operating Cash Income	Explor. Operating Expense	Devel. Overhead Expense[1]	Research and Devel. Expense	Cash Income Before Tax
1959	5,686	1,282	158	63	4,183
1960	5,888	1,292	151	69	4,376
1961	6,122	1,324	163	70	4,565
1962	6,326	1,383	171	72	4,700
1963	6,619	1,373	168	74	5,004
1964	6,655	1,445	165	93	4,952
1965	6,757	1,436	174	94	5,053
1966	7,201	1,478	168	88	5,467
1967	7,851	1,459	192	88	6,112
1968	8,205	1,498	199	104	6,404
1969	8,845	1,560	207	112	6,966
1970	9,408	1,450	220	123	7,615
1971	9,943	1,508	202	122	8,111
1972	9,966	1,645	257	114	7,950
1973	11,439	1,835	250	121	9,233
1974	18,796	2,695	272	151	15,678
1975	21,193	3,242	452	167	17,332
1976	23,762	3,188	355	179	20,040
1977	27,772	3,940	384	210	23,238
1978	30,850	5,127	440	250[2]	25,033

[1] Thirty five percent of Production Department overhead during 1959-1965, based upon JAS allocations during 1966-1975.

[2] An order of magnitude provisional entry for sake of completeness.

Chapter IV

Income Taxes

The major deductions (for tax purposes) from cash income before tax are briefly discussed in this Chapter. These taxes relate to operating cash income (Chapter II) the expensed reinvestment program (Chapter III) and capital expenditures (Chapter V).

A. *Outer Continental Shelf Leases*

U. S. Geological Survey tabulations pertaining to lease sales and productivity data and lease expiry lists for all outer continental shelf (OCS) areas have been obtained. The surrendered lease bonus amounts, according to sale, have been summarized on Table 1 for general sales in the Gulf of

TABLE IV-1

U.S. INDUSTRY
OCS GULF OF MEXICO GENERAL SALES STATUS AT 12/31/78
MM$

			AMOUNTS SURRENDERED BEFORE 1/1/79	
Sale Date	*State*	*Bonus*	*Non-Prod.*	*With Very Small Production*
10/54	LA	116.4	30.0	20.6
11/54	TX	23.4	11.0	
7/55	LA	100.1	40.9	3.2
7/55	TX	8.4	8.4	
5/59	FL	1.7	1.7	
2/60	LA	246.9	77.1	1.1
2/60	TX	35.7	17.0	
3/62	LA	445.0	198.9	4.8
3/62	TX	0.6	0.6	
6/67	LA	510.1	226.1	18.5
5/68	TX	593.9	434.7	52.1
12/70	LA	847.3	253.5	
9/72	LA	585.8	325.8	
12/72	LA	1,665.5	454.3	
6/73	TX	1,537.5	400.1	
12/73	MAFLA	1,491.1	1,346.0	
3/74	LA	2,092.5	89.6	
5/74	TX	1,471.9	89.6	
7/74	LA-TX	30.2	6.4	
10/74	LA	1,428.3	92.6	
2/75	TX	274.7	13.6	
5/75	LA-TX	232.9	13.4	
7/75	LA-TX	163.2	-	
2/76	LA-TX-FL	176.0	-	
11/76	LA-TX	379.1	-	
6/77	LA-TX	1,170.1	2.4	
4/78	LA-TX	733.7	-	
10/78	AL-FL	61.2	-	
12/78	LA-TX	871.5	-	
	TOTAL	17,294.6	4,133.7	100.3

Mexico, on Table 2 for general sales other than Gulf of Mexico, and on Table 3 for drainage sales. These data are further summarized, according to year of surrender, on Table 4. These surrender amounts are included within the amounts under Column B of Table 11.

TABLE IV-2

U.S. INDUSTRY
OCS GENERAL SALES OTHER THAN GULF OF MEXICO
STATUS AT 12-31-78
MM$

Sale Date	*Area*	*Bonus*	*Amounts Surrendered Before 1-1-79*
5/63	California	12.8	12.8
10/64	Washington-Oregon	35.5	35.5
2/68	California	602.7	261.1
12/75	California	417.3	-
4/76	Gulf of Alaska	559.8	134.1
8/76	Mid-Atlantic	1,127.9	-
10/77	Cook Inlet	398.5	-
3/78	South Atlantic	100.7	-
	TOTAL	3,255.4	443.5

TABLE IV-3

U.S. INDUSTRY
OCS DRAINAGE SALES STATUS AT 12-31-78
MM$

			Amounts Surrendered Before 1-1-79	
Sale Date	*State*	*Bonus*	*Non Prod.*	*With Very Small Production*
8/59	LA	88.0	8.2	18.6
10/62	LA	43.9	8.9	
4/64	LA	60.3	3.2	
3/66	LA	88.8	10.8	4.0
10/66	LA	99.2	30.9	
12/66	California	21.2	-	
11/68	LA	149.9	20.1	
1/69	LA	44.0	14.6	10.8
12/69	LA	66.9	0.9	
7/70	LA	98.0	4.9	
11/71	LA	96.3	14.4	7.0
6/73	LA	53.9	1.5	
	TOTAL	910.4	118.4	40.4

TABLE IV-4

U.S. INDUSTRY
SURRENDERED LEASES SUMMARY
BONUS $MMs

Year of Surrender	Gulf of Mexico: General Non Prod.	Gulf of Mexico: General With Very Small Prod.	Gulf of Mexico: Drainage Non Prod.	Gulf of Mexico: Drainage With Very Small Prod.	Pacific Coast	Southern Alaska	Atlantic Coast	Other Than OCS	Total
1959	26.3							402.1	428.4
1960	33.1							412.7	445.8
1961	1.8							392.9	394.7
1962	8.6		4.1					367.5	380.2
1963	16.8	3.0	1.5					347.5	368.8
1964	10.2	8.3	2.6	1.0	0.1			334.3	356.5
1965	60.2	5.3	0.4		1.2			340.9	408.0
1966	21.6				13.3			344.7	379.6
1967	124.0	0.2	3.3		30.4			331.5	489.4
1968	3.9		15.4	10.8	2.2			309.8	342.1
1969	17.8		13.3		46.2			297.9	375.2
1970	82.2	5.3	8.2		0.2			343.2	439.1
1971	99.4		14.1	4.8				371.5	489.8
1972	229.5	1.5	5.6		36.1			303.0	575.7
1973	153.4		23.2	6.0	74.5			264.2	521.3
1974	201.0		0.7	10.8				246.5	459.0
1975	283.6	15.2	10.3					213.3	522.4
1976	256.3	16.7	14.4	0.8	3.1			241.0	532.3
1977	600.8			6.3				338.7	945.8
1978	1,892.1	44.8	1.5		102.0	134.1		465.0	2,639.5
	4,122.6	100.3	118.6	40.5	309.3	134.1	-	6,668.2	11,493.6

(1) Does not include $6.7 in 1957 and $4.5 in 1958.

For OCS sales prior to 1962, it is believed that almost all bonus amounts not surrendered are in the productive category. However, as shown in Table 5, about $1.5 billion of lease bonus amounts appropriate to OCS sales during 1962-73 are still held as nonproducing on 12/31/78. The remaining unsurrendered amounts are considered as productive and are shown under the first two columns of Table 6, according to year of transfer to production. OCS sales after 1973 are not estimated to have resulted in significant transfers to productive category by 12/31/78.

TABLE IV-5

U.S. INDUSTRY
STATUS OF OCS SALES 1962-1973 @ 12/31/78
(MMS)

Sale Date	*State*		*Surr. As Non Producing*	*Surr. After Production*	*Still Producing*	*Non Producing*	*Total*
03/62	La.-Tx.	Tracts	245	18	145	3	411
		Bonus	200	15	230	-	446
06/67	La.	Tracts	104	7	43	4	158
		Bonus	226	21	241	21	510
02/68	Calif.	Tracts	35	-	2	34	71
		Bonus	279	-	100	224	603
05/68	Tx.	Tracts	94	5	11	-	110
		Bonus	435	63	96	-	594
12/70	La.	Tracts	55	-	52	12	119
		Bonus	253	-	514	80	847
09/72	La.	Tracts	49	-	7	6	62
		Bonus	326	-	192	68	586
12/72	La.	Tracts	62	-	31	23	116
		Bonus	454	-	893	318	1,665
06/73	Tx.	Tracts	53	-	14	29	96
		Bonus	400	-	395	742	1,537
12/73	MAFLA	Tracts	85	-	2	-	87
		Bonus	1,398	-	93	-	1,491
TOTAL		TRACTS	782	30	307	111	1,230
		BONUS	3,971(1)	99	2,754	1,453	8,280

(1) Includes $18MM (6/67 Sale) and $51MM (12/73 Sale) surrendered during first quarter of 1979.

B. *Leases Other Than OCS*

It is estimated that 80 percent of the non-OCS lease bonus amounts are surrendered according to a ten year model pattern and these surrenders, according to year of surrender, are shown by the next to last column of Table 4. They are also included within Column B of Table 11.

The productive leases in the other than OCS category are estimated as 20 percent of the bonus amounts, and these transfers to productive classification are time centered four years after acquisition, according to the next to last column of Table 6.

TABLE IV-6

U.S. INDUSTRY
ADDITIONS TO PRODUCING LEASEHOLDS
MM$

Year of Transfer To Productive Status	O.C.S. Annual (1)	O.C.S. Three Year Moving Average	Other (2)	Total
1959		26	108	134
1960	79	45	112	157
1961	56	45	114	159
1962		19	114	133
1963		-	93	93
1964		20	69	89
1965	61	83	86	169
1966	188	83	65	148
1967		155	73	228
1968	276	92	95	187
1969		111	88	199
1970	57	19	74	93
1971		73	64	137
1972	163	136	46	182
1973	244	254	205	459
1974	354	228	31	259
1975	85	349	32	381
1976	607	256	45	301
1977	75	589	45	634
1978	1,085	584	45	629
1979	592			
1959-1978		3,290	1,604	4,894

(1) Six years after sale year.
(2) Four years after sale year.

C. *Dry Holes*

Dry hole costs are as reported by JAS — Section 1 for the entire time period. They have been reduced by the test well contribution amounts on Table III-1. The development dry hole cost deductions (for tax purposes) are listed under Column A of Table 11.

D. *Capitalized Geological and Geophysical (G&G) Expenses*

It is estimated that G&G expenses, shown on Table III-1, were 53 percent suspended or capitalized during 1959-1965 and 59 percent after 1965. Furthermore, it is estimated that 75 percent of these suspended or capitalized amounts are later expensed or surrendered over a ten-year model pattern. The net adjustment (tax versus corporate books) for these G&G transactions is summarized under Column C of Table 11.

E. Intangible Development

The subdivision of productive drilling expenditures into the tangible and intangible categories is shown on Table 7. The intangible ratio was assumed as 70 percent after 1964 based upon 1955-64 data. This assumption is also supported by Price Waterhouse tax study data for 18 large companies during 1970-1977.

TABLE IV-7

U.S. INDUSTRY
PRODUCTIVE DRILLING COSTS
TANGIBLE AND INTANGIBLE PORTIONS
MMS

			Productive			
Year	*Total*	*Dry*	*Total*	*Tang*	*Intang*	*Portion Intang*
1959	2,651	821	1,830	549	1,281	.700
1960	2,424	774	1,650	475	1,174	.712
1961	2,398	774	1,624	467	1,157	.712
1962	2,577	847	1,730	494	1,236	.714
1963	2,303	790	1,513	439	1,074	.710
1964	2,427	854	1,573	442	1,131	.710
1965	2,401	849	1,552	466	1,086	.700
1966	2,361	832	1,529	459	1,070	.700
1967	2,299	802	1,497	449	1,048	.700
1968	2,409	826	1,583	475	1,108	.700
1969	2,611	888	1,723	517	1,206	.700
1970	2,579	873	1,706	512	1,194	.700
1971	2,371	864	1,507	452	1,055	.700
1972	2,814	1,006	1,808	542	1,266	.700
1973	3,075	1,070	2,005	601	1,404	.700
1974	4,367	1,660	2,707	812	1,895	.700
1975	6,571	2,309	4,262	1,279	2,983	.700
1976	7,462	2,505	4,957	1,487	3,470	.700
1977	9,956	3,285	6,671	2,001	4,670	.700
1978	13,061	4,382	8,679	2,604	6,075	.700

(1) Includes exploration. Test well contributions not deducted.

(2) Estimated as 0.700 after 1964.

(3) 0.732 in 1955 and 0.730 in 1956.

Table 8 completes the tangible-intangible subdivision. Improved recovery programs and lease equipment expenditures are assumed to be 65 percent and 100 percent tangible respectively.

The intangible development expenditures are also summarized under Column D of Table 11.

TABLE IV-8

INDUSTRY USA
OIL & GAS FIELD TANGIBLE AND INTANGILLE EXPENDITURES
MM$

	Tangible				*Intangible*		
Year	*Productive Drilling*	*65% of Improved Recovery Programs*	*Lease Equip & Other Devel*	*Total*	*Productive Drilling*	*35% of Improved Recovery Programs*	*Total*
1959	549		483	1,032	1,281		1,281
1960	476		431	907	1,174		1,174
1961	467		446	913	1,157		1,157
1962	494		537	1,031	1,236		1,236
1963	439		527	966	1,074		1,074
1964	442		619	1,061	1,131		1,131
1965	466		580	1,046	1,086		1,086
1966	459	122	691	1,272	1,070	65	1,135
1967	449	161	744	1,354	1,048	86	1,134
1968	475	144	746	1,365	1,108	78	1,186
1969	517	197	622	1,336	1,206	106	1,312
1970	512	185	613	1,310	1,194	100	1,294
1971	452	210	573	1,235	1,055	113	1,168
1972	542	201	657	1,400	1,266	109	1,375
1973	601	179	713	1,493	1,404	97	1,501
1974	812	259	1,119	2,190	1,895	140	2,035
1975	1,279	361	1,741	3,381	2,983	195	3,178
1976	1,487	246	2,466	4,199	3,470	132	3,602
1977	2,001	300	2,286	4,587	4,670	161	4,831
1978	2,604	415	2,644	5,663	6,075	224	6,299

F. *Depreciation of Productive Tangible Development and Equipment*

In order to maximize depreciation, it is believed that most operators would have used depreciation procedures as follows:

1. *Unrecovered Assets at 12 31 58 and additions during 1959-1962.* Unit of Production (U.O.P.) basis through 1961. Straight line (14 years) starting in 1962. All pre-1963 accounts grouped and prior depreciation retained in aggregation. Entire pre-1963 assets depreciated by 1970.

2. *Additions 1963-1970.* Double declining balance (14 years).

3. *Additions 1971-1978.* DDB (11 years) for 1.5 years and Sum of Year's Digits (SYD) for 9.5 years.

These various depreciations are summarized on Table 9 and carried forward to Column E of Table 11.

TABLE IV-9

U.S. INDUSTRY
OIL & GAS FIELD TANGIBLE DEPRECIATION
FOR TAX PURPOSES
(MM$)

Year	Net Assets at 12/31/58	1959-1962 Additions	1963-1970 Additions	1971-1978 Additions	Total
1959	625	52			677
1960	563	143			706
1961	506	220			726
1962	570	350			920
1963	570	415	69		1,054
1964	570	415	204		1,189
1965	570	415	325		1,310
1966	570	415	444		1,429
1967	570	415	569		1,554
1968	570	415	682		1,667
1969	566	415	777		1,758
1970		213	855		1,068
1971			826	112	938
1972			708	331	1,039
1973			607	542	1,149
1974			521	800	1,321
1975			446	1,192	1,638
1976			382	1,714	2,096
1977			328	2,271	2,599
1978			281	2,880	3,161

(1) Unrecovered cost at 12/31/58 estimated as $6,250. See Table 1, Chapter VII.

G. *Depletion*

Percentage depletion has been calculated as 21 percent of oil and gas revenue after royalty during 1959-69; 18 percent during 1970-74; and 2 percent after 1974. The 21 percent and 18 percent average rates cited above are generally supported by congressional testimony of the Joint Committee on Taxation staff and by summary findings of the Price-Waterhouse tax study of the larger companies. The 2 percent average percentage depletion rate for the post 1974 period is supported by Joint Congressional Committee on Taxation findings that 11.5 percent of current oil volumes represent working interest production of independent producers still eligible for percentage depletion.

Cost depletion for leases tranferred to producing status during 1975-1978 (see Table 6) is shown by the top portion of Table 10. Cost depletion of estimated unrecovered costs at 12/31/74, of leases transferred to productive status before 1975, is shown on the central portion of Table 10.

All categories of percentage and cost depletion are summarized under Column F of Table 11.

TABLE IV-10

U.S. INDUSTRY
DEPLETION FOR TAX PURPOSES AFTER 1974
MMS

ON ACCOUNT OF
NEW PRODUCING LEASES

Year	*Lease Bonus*	*Capitalized G&G*	*Total Basis*	*Costs Depl.*	*Net Assets at 12/31*	*Rate*
1974					-	
1975	381	53	434	27	407	.125
1976	301	55	356	73	690	.125
1977	634	63	697	130	1,257	.125
1978	629	94	723	202	1,778	.125

ON ACCOUNT OF UNRECOVERED
COSTS AT 12/31/74

1974					600	
1975				75	525	.125
1976				66	459	.125
1977				57	402	.125
1978				50	352	.125

ON ACCOUNT OF PERCENTAGE
DEPLETION AFTER 1974

YEAR	REVENUE EX ROYALTY	DEPL.	RATE
1975	27,252	745	.02
1976	30,432	609	.02
1977	35,374	707	.02
1978	39,579	792	.02

TABLE IV-11
U.S. INDUSTRY
CRUDE OIL AND NATURAL GAS ACTIVITIES
WRITE-OFFS FOR TAX PURPOSES
MM$

Year	Development Dry Holes	Surr. Leases	Capitalized G&G Adj.	Intangible Development	Depr.	Depletion	Total
	A	B	C	D	E	F	G
1959	359	428	(28)	1,281	677	1,612	4,329
1960	324	446	(10)	1,174	706	1,644	4,284
1961	318	395	(13)	1,157	726	1,707	4,290
1962	339	380	(24)	1,236	920	1,771	4,622
1963	296	369	(26)	1,074	1,054	1,838	4,605
1964	309	357	(41)	1,131	1,189	1,857	4,802
1965	304	408	(47)	1,086	1,310	1,902	4,963
1966	305	380	(135)	1,135	1,429	2,040	5,154
1967	289	489	(130)	1,134	1,554	2,191	5,527
1968	302	342	(98)	1,186	1,667	2,314	5,713
1969	320	375	(90)	1,312	1,758	2,478	6,153
1970	340	439	(55)	1,294	1,068	2,283	5,369
1971	308	490	(55)	1,168	938	2,414	5,263
1972	366	576	(58)	1,375	1,039	2,431	5,729
1973	395	521	(90)	1,501	1,149	2,747	6,223
1974	526	459	(211)	2,035	1,321	4,308	8,438
1975	830	522	(223)	3,178	1,638	647	6,592
1976	988	532	(185)	3,602	2,096	748	7,781
1977	1,338	946	(253)	4,831	2,599	894	10,355
1978	1,632	2,640	(330)	6,299	3,161	1,044	14,446

H. *Income Tax Summary*

The income tax estimates are summarized on Table 12. The use of corporation income tax rates in this study is based upon Census data which indicate that over 90 percent of crude oil and natural gas volumes are produced by the largest 200 companies. Average nationwide state income taxes are estimated as 2 percent of federally taxed income (the 2 percent is after deduction of state income taxes from federally taxable income).

I. *Negative Income Taxes, Investment Tax Credits, and Minimum Tax*

The comparisons between the investment tax credits generated by oil and gas field activities and income taxes paid by these activities indicate difficulty in validating these credits during 1962-1967 unless additional taxes were paid by other functions on the same return.

The comparisons between the depletion allowance and taxes paid by oil and gas field activities indicate that minimum taxes might have been payable during 1970-1974 unless the minimum tax could be avoided because of additional taxes payable by other functions on the same tax return.

Finally, it would be necessary to have additional taxes payable by other functions on the same return in order to take advantage of the negative income taxes indicated for oil and gas field activities during 1959.

TABLE IV-12
U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
FEDERAL AND STATE INCOME TAXES
MMS

Year	Cash Income Before Tax	Tax Write-offs	Taxable Income	Tax Rate	Income Tax	Investment Tax Credit	Adjustment For Tax Credits and Min. Tax	State Income Taxes Etc.	Cash Income After Tax
1959	4,183	4,329	(146)	.52	(76)	-	38	(3)	4,224
1960	4,376	4,284	92	.52	48	-	-	2	4,326
1961	4,565	4,290	275	.52	143	-	-	6	4,416
1962	4,700	4,622	78	.52	41	72	31	2	4,698
1963	5,004	4,605	399	.52	207	68	8	8	4,849
1964	4,952	4,802	150	.50	75	74	28	3	4,920
1965	5,053	4,963	90	.48	43	73	31	2	5,050
1966	5,467	5,154	313	.48	150	69	16	6	5,364
1967	6,112	5,527	585	.48	281	77	4	12	5,892
1968	6,404	5,713	691	.528	365	96	-	14	6,121
1969	6,966	6,153	813	.528	429	28	-	16	6,549
1970	7,615	5,369	2,246	.492	1,105	-	50	45	6,415
1971	8,111	5,263	2,848	.48	1,367	65	43	57	6,709
1972	7,950	5,729	2,221	.48	1,066	98	59	44	6,879
1973	9,233	6,223	3,010	.48	1,445	105	54	60	7,779
1974	15,678	8,438	7,240	.48	3,473	153	34	145	12,179
1975	17,332	6,592	10,740	.48	5,155	338	-	215	12,300
1976	20,040	7,781	12,259	.48	5,884	420	-	245	14,331
1977	23,238	10,355	12,883	.48	6,184	459	-	258	17,255
1978	25,033	14,446	10,587	.48	5,082	566	-	212	20,305

(1) These adjustments are equivalent to additional taxation.
(2) After deduction for federal income tax.

TABLE IV-13
U.S. INDUSTRY
OIL & GAS FIELD ACTIVITIES
ESTIMATE OF TAX VULNERABILITY ON
ACCOUNT OF TAX CREDITS AND MINIMUM TAX
(MMS)

Year	Maximum Interfunctional Tax Vulnerability: Negative Tax	Investment Tax Credit	Minimum Tax	Total	50% of Maximum Vulnerability	Impact on Net Income (%)
1959	76			76	38	2.1
1962		62		62	31	1.5
1963		16		16	8	0.4
1964		55		55	28	1.3
1965		62		62	31	1.4
1966		32		32	16	0.6
1967		7		7	4	0.1
1970			100	100	50	1.5
1971			85	85	43	1.2
1972			117	117	59	1.7
1973			108	108	54	1.3
1974			66	66	34	0.4

(1) Investment tax credit in excess of 25% of taxes paid.

(2) (Excess of allowable depletion over cost depletion in excess of taxes paid) x 10%.

Excess of allowable depletion over cost depletion estimated as 92% of allowable depletion during 1970-1973 and 96% during 1974.

It is assumed that the benefits from the negative taxes, the investment tax credits, or the avoidance of the minimum taxes should accrue to the oil and gas field activity function — regardless of how these credits are validated or how the minimum tax is avoided.

It is believed that during some years, most of the credits could be validated and the minimum tax avoided, while in other years the opposite situation could obtain. Because the income tax situation of related functions is not known, it has been decided to strike a halfway position in estimating the minimum taxes and unvalidated tax credits. These estimated amounts would, thus, also equal the maximum uncertainty of the true tax amounts. These estimates are shown on Table 13. The maximum uncertainties are also compared to net income. The magnitudes of the impact on net income are small enough to be acceptable in a study such as this.

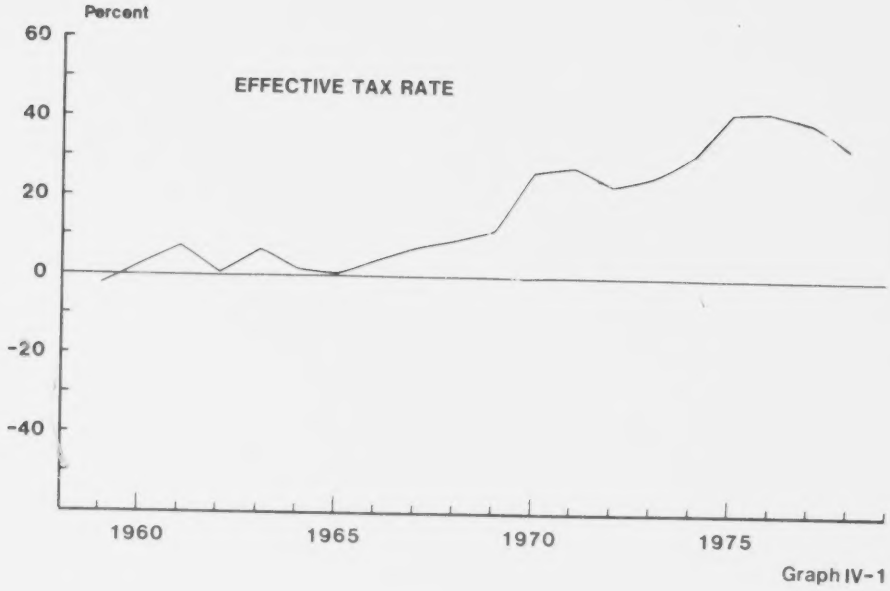
J. *Effective Tax Rate*

Table 14 and Graph 1 show the average effective tax rates which are defined as the ratios of income taxes to net income before tax.

TABLE IV-14

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
EFFECTIVE TAX RATE
MMS

Year	*Net Income After Tax*	*Income Taxes*	*Net Income Before Tax*	*Effective Tax Rate*
1959	1,795	(41)	1,754	(.0231)
1960	1,892	50	1,942	.026
1961	1,973	149	2,122	.070
1962	2,074	2	2,076	.001
1963	2,225	155	2,380	.065
1964	2,193	32	2,225	.014
1965	2,247	3	2,250	.001
1966	2,497	103	2,600	.040
1967	2,864	220	3,084	.071
1968	2,860	283	3,143	.090
1969	3,093	417	3,510	.119
1970	3,237	1,200	4,437	.270
1971	3,621	1,402	5,023	.279
1972	3,546	1,071	4,617	.232
1973	4,270	1,454	5,724	.254
1974	8,039	3,499	11,538	.303
1975	6,930	5,032	11,962	.421
1976	7,803	5,709	13,512	.423
1977	9,030	5,983	15,013	.399
1978	9,306	4,728	14,034	.337


Percent
60
40
20
0
-20
-40
EFFECTIVE TAX RATE
1960
1965
1970
1975

Graph IV-1

Chapter V

Capital Expenditures and the Reinvestment Program

Capital expenditures for crude oil and natural gas activities are listed on Table 1. JAS-Section 2 reports were the source of the data through 1975. After 1975, the data sources were JAS-Section 1 reports for drilling costs and Census Bureau reports for the nondrilling expenditures. The splits of drilling costs between exploration and development for 1976 and 1977 were estimated based upon well count and footage drilled data from API-AAPG which are reported according to function. Starting with 1978, JAS-Section 1 drilling cost reports contain a functional subdivision.

Table 2 shows the comparisons between JAS and Census capital expenditure data for 1973-74-75. The Census drilling expenditure data are lower than JAS and especially so for development drilling. During 1977 and 1978 Census canvassed, for the first time, well count and footage drilled

TABLE V-1

U.S. INDUSTRY
CRUDE OIL AND NATURAL GAS ACTIVITIES
CAPITAL EXPENDITURES
MMS

	Drilling						Improved Recovery		
Year	Productive Exploration	Devel	Total	O.C.S. Leases	Other Leases	Lease Equip	Programs	Other	Total
1959	359	1,830	2,189	90	464	483			3,226
1960	324	1,651	1,975	283	343	431			3,032
1961	318	1,624	1,942	-	428	446			2,816
1962	339	1,729	2,068	489	326	537			3,420
1963	296	1,512	1,808	13	363	527			2,711
1964	309	1,574	1,883	96	474	619			3,072
1965	304	1,553	1,857	-	438	580			2,875
1966	276	1,557	1,833	209	368	572	187	119	3,288
1967	314	1,472	1,786	510	319	575	247	169	3,606
1968	346	1,539	1,885	1,346	232	558	222	188	4,431
1969	409	1,634	2,043	111	1,026	442	303	180	4,105
1970	312	1,733	2,045	945	157	443	285	170	4,045
1971	243	1,573	1,816	96	158	388	323	185	2,966
1972	305	1,869	2,174	2,251	223	497	310	160	5,615
1973	384	2,016	2,400	3,082	224	524	276	189	6,695
1974	547	2,686	3,233	5,023	224	770	399	349	9,998
1975	858	4,234	5,092	1,088	591	1,323	556	418	9,068
1976	909	5,036	5,945	2,243	781	1,487	378	979	11,813
1977	1,180	6,829	8,009	1,569	1,018	1,614	461	672	13,343
1978	1,496	8,815	10,311	1,767	1,145	2,176	639	468	16,506

(1) Additions to working capital are discussed in Chapter VIII.

(2) Included with lease equipment prior to 1966.

data along with the cost data. It is apparent that their coverage has omitted each year about 30 percent of the wells — even after gross up to a nationwide total. This is why JAS-Section 1 drilling cost data have been used for this study — even after 1975.

TABLE V-2

U.S. INDUSTRY
CRUDE OIL AND NATURAL GAS CAPITAL EXPENDITURES[1]
COMPARISONS BETWEEN JAS AND CENSUS
MM$

	1973		1974		1975	
	JAS	*CENSUS*	*JAS*	*CENSUS*	*JAS*	*CENSUS*
EXPLORATION						
Leases	3,646	3,552	5,659	5,774	1,679	1,615
Drilling	1,021	944	1,647	1,581	2,298	2,124
TOTAL	4,667	4,496	7,306	7,355	3,977	3,739
DEVELOPMENT						
Drilling	2,016	1,767	2,686	2,265	4,234	3,355
Lease Equipment	524	572	770	824	1,323	1,500
Improved Recovery Programs	276	353	399	625	558	929
Other	189		349		418	
General & Administrative Overhead	250	165	272	224	452	336
TOTAL	3,255	2,857	4,476	3,938	6,983	6,120

(1) Includes all exploratory drilling.

TABLE V-3

U.S. INDUSTRY
DRILLING COSTS IN PROGRESS ADJUSTMENT
(MM$)

Year	*Exploration*	*Development*	*Total*
NET COMPANY INTEREST STATISTICS			
1973	79.2	129.5	208.7
1974	182.5	229.6	412.1
1975	177.5	444.9	622.4
1976	139.7	648.0	787.7
1977	423.3	554.2	977.5
1978	341.6	984.3	1,325.9
GROSS OPERATOR BASIS STATISTICS			
1973	105.6	199.4	305.0
1974	126.4	282.4	408.8
1975	214.0	517.5	731.5
1976	254.7	908.5	1,163.2
1977	461.1	638.3	1,099.4
1978	470.6	1,318.3	1,788.9

(1) Increase in work in progress during year.

Prior to 1976, JAS did not report any difference between Section 2 drilling expenditures during the year — regardless of completion date — and the Section 1 cost of wells completed during the year — regardless of expenditure date. This is because JAS assumed that the work in progress adjustment would balance from year-to-year. This was probably an acceptable assumption, broadly speaking, over the 1959-1971 period during which time costs of wells completed each year did not vary significantly away from an average of $2.4 billion (see Table IV-7).

Since 1971, the costs of wells completed each year have risen from $2,371 million during 1971 to $13,061 million during 1978. The magnitude of work in progress at year end, as reported by Census for 1972-1978, has increased each year. These data are listed and compared on Tables 3 and 4.

The intangible portions of the drilling work in progress adjustment can be deducted for income tax purposes, which would improve net cash flow by 0.70 x 0.48 or 0.336 of the adjustment. It is not considered likely that the tangible portions of work in progress would be depreciated for tax purposes and the book write-off procedures of this analysis do not commence U.O.P. write-offs until wells are completed. Any tax advantage based upon intangible drilling costs in progress would be cancelled, for net income purposes, by interperiod tax allocation accounting.

In summary, drilling work in progress adjustments are ignored for tax and book write-off purposes and only 66.4 percent of the adjustments are deducted in the cash flow analysis.

TABLE V-4

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
DRILLING WORK IN PROGRESS
MM$

Year	*Costs of Wells Completed During Year*	*Drilling Work in Progress Adjustment*	*Total Drilling Expenditures*	*Work in Progress at End of Year*	*WIP as Portion of Total Expenditures*
1971	2,371	-	2,371	1,225[1]	.517
1972	2,814	-[2]	2,814	1,225	.435
1973	3,075	305	3,380	1,530	.453[3]
1974	4,367	409	4,776	1,939	.406
1975	6,571	732	7,303	2,671	.366
1976	7,462	1,163	8,625	3,834	.445
1977	9,956	1,099	11,055	4,933	.446
1978	13,061	1,789	14,850	6,722	.453[3]

(1) Approximate year-end WIP level for 1959-1971 period of somewhat constant drilling expenditures.

(2) Possible small increase not recorded.

(3) Based upon an increase in drilling work in progress of $5,912 million during 1974-1978 while drilling expenditures increased from $3,380 million in 1973 to $14,850 million in 1978.

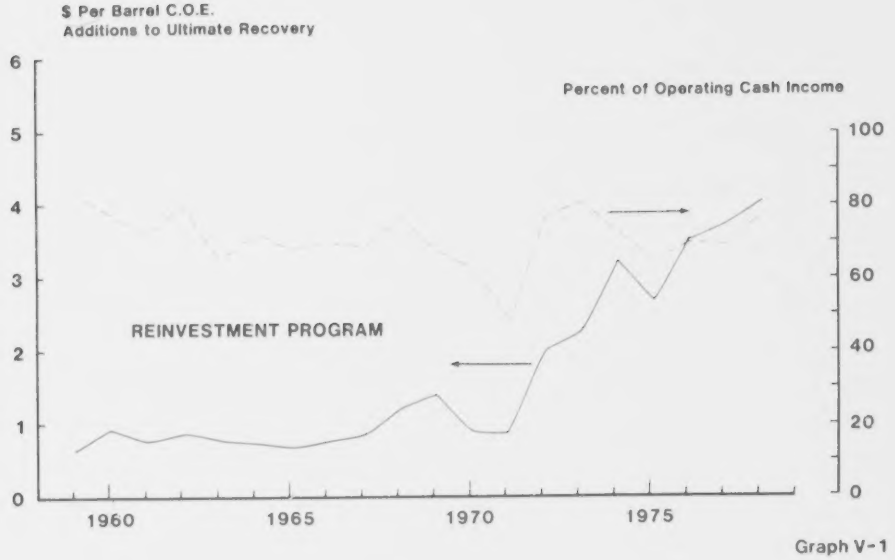
The USA industry reinvestment program into oil and gas field activities is summarized on Table 5. Reinvestment into activities directed toward future incomes consists of capital expenditures, research and development expenses, exploration operating expenses, development overhead expenses, and the drilling work in progress adjustment. Reinvestment remained in the $4.5 to $5.0 billion range, annually, during the first eight years 1959-1966, and averaged $5.6 billion annually during the next five years 1967-1971. Since then, industry reinvestment has risen steeply from $4.8 billion during 1971 to $24.1 billion during 1978.

The last two columns of Table 5 and Graph 1 compare reinvestment with operating cash income — the pretax funds available from production operations. Reinvestment has absorbed 77 percent of operating funds during the first three years and 72 percent during the next three years. During 1965-1977, the reinvestment ratio has remained very close to 68-69 percent of operating cash income — when averaged over three-year periods. The reinvestment ratio was 78 percent during 1978. Because of relative increases in income taxation since 1969 and relative increases in capital expenditures since 1971, the effectiveness of any particular reinvestment ratio level will

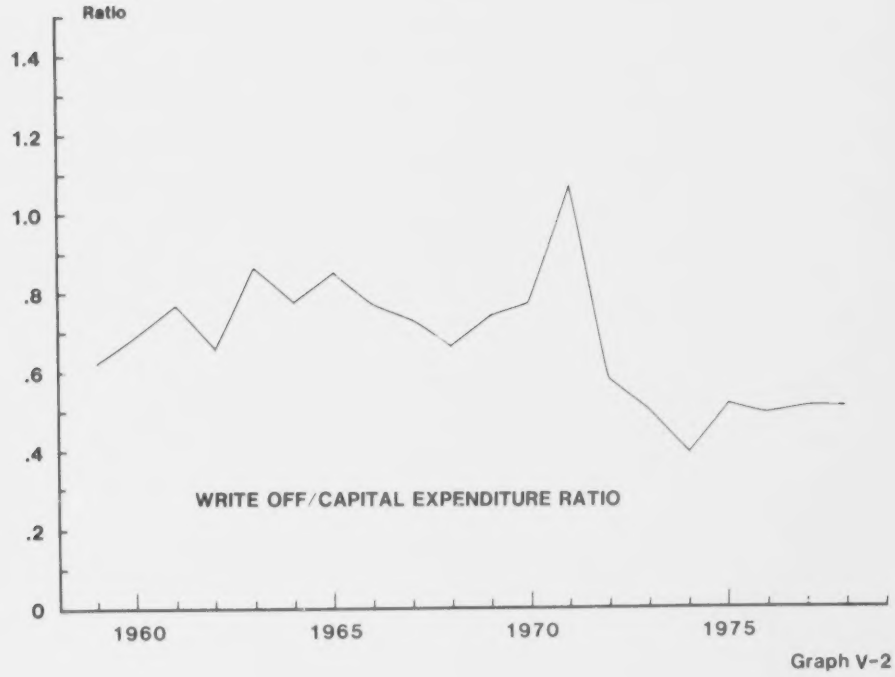
TABLE V-5

U.S. INDUSTRY
OIL & GAS FIELD ACTIVITIES
REINVESTMENT COMPARED TO OPERATING CASH INCOME
(MMS)

	Reinvestment							
Year	Capital Expend.	R&D Expense	Explor Oper. Expense	Devel Ovhd Expense	Drlg. Work in Prog. Adj.	Total	Operating Cash Income	Reinvestment as Portion of OCI
1959	3,226	63	1,282	158		4,729	5,686	.832
1960	3,032	69	1,292	151		4,544	5,888	.772
1961	2,816	70	1,324	163		4,373	6,122	.714
1962	3,420	72	1,383	171		5,046	6,326	.798
1963	2,711	74	1,373	168		4,326	6,619	.654
1964	3,072	93	1,445	165		4,775	6,655	.718
1965	2,875	94	1,436	174		4,579	6,757	.678
1966	3,288	88	1,478	168		5,022	7,201	.697
1967	3,606	88	1,459	192		5,345	7,851	.681
1968	4,431	104	1,498	199		6,232	8,205	.760
1969	4,105	112	1,560	207		5,984	8,834	.677
1970	4,045	123	1,450	220		5,838	9,408	.621
1971	2,966	122	1,508	202		4,798	9,943	.482
1972	5,615	114	1,645	257		7,631	9,966	.767
1973	6,695	121	1,835	250	305	9,206	11,439	.805
1974	9,998	151	2,695	272	409	13,525	18,796	.720
1975	9,068	167	3,242	452	732	13,661	21,193	.645
1976	11,813	179	3,188	355	1,163	16,698	23,762	.703
1977	13,343	210	3,940	384	1,099	18,976	27,772	.683
1978	16,506	250(P)	5,127	440	1,789	24,112	30,850	.782
1959-1978						169,400		



Graph V-1



Graph V-2

change across the review period. This is pointed up in the Chapter I Summary and Graph I-6.

The R and D, exploration operating, and development overhead expense portions of the reinvestment program are charged to income as incurred while the capital expenditure portions are recovered through write-off provisions. Table 6 and Graph 2 compare write-offs (as subsequently estimated in Chapter VII) with capital expenditures for the U.S. industry oil and gas field activities. Because of cost inflation, increase in activity, maturity and increase in complexity, write-off provisions have generally been considerably less than capital expenditure requirements and this shortfall has become more pronounced since 1971 (a year of reduced capital requirements because of the absence of general lease sales in the O.C.S). Write-offs have covered, on average, 76 percent of capital expenditure requirements during 1959-1971 and 50 percent starting in 1972.

Tables 7, 8, and 9 show the U.S. crude oil, lease condensate, and natural gas additions to ultimate recovery which have been recorded each year by the API/AGA reserves committees. These series have been further adjusted

TABLE V-6

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
CAPITAL EXPENDITURES COMPARED TO WRITE-OFFS
MMs

Year	Capital Expenditures	Write-Offs	Write-Offs as Portion of Capital Expenditures
1959	3,226	1,998	.619
1960	3,032	2,090	.689
1961	2,816	2,167	.770
1962	3,420	2,250	.658
1963	2,711	2,342	.864
1964	3,072	2,394	.779
1965	2,875	2,457	.855
1966	3,288	2,529	.769
1967	3,606	2,630	.729
1968	4,431	2,951	.666
1969	4,105	3,051	.743
1970	4,045	3,127	.773
1971	2,966	3,179	1.072
1972	5,615	3,233	.576
1973	6,695	3,396	.507
1974	9,998	3,992	.399
1975	9,068	4,672	.515
1976	11,813	5,871	.497
1977	13,343	6,873	.515
1978	16,506	8,511	.516

(1) Excludes drilling work in progress adjustment.
(2) 1959-1971: 0.761
1972-1978: 0.500

to spread the Prudhoe Bay Field ultimate recovery (9.4 billion barrels of crude oil and 26 trillion cubic feet of natural gas) over the 1968-1979 period as the oil wells were completed instead of entirely during 1970. These annual volume additions are further summarized under the second column of Table 10.

TABLE V-7

U.S. INDUSTRY
CRUDE OIL ADDITIONS TO ULTIMATE RECOVERY
(MMB & 10^12 BTU)

Year	Revisions	Extensions	New Fields	New Reservoirs in Old Fields	Total	Prudhoe Bay Adjustment	Adjusted Total MMB	Adjusted Total 10^12 BTU
1959	1,519	1,779	166	204	3,667		3,667	21,269
1960	788	1,324	141	113	2,365		2,365	13,717
1961	1,087	1,209	107	254	2,658		2,658	15,416
1962	759	1,041	92	288	2,181		2,181	12,650
1963	966	858	97	253	2,174		2,174	12,609
1964	899	1,419	127	220	2,665		2,665	15,457
1965	1,783	793	237	235	3,048		3,048	17,678
1966	1,839	814	160	150	2,964		2,964	17,191
1967	1,901	716	125	220	2,962		2,962	17,180
1968	1,320	777	166	191	2,455	34	2,489	14,436
1969	1,258	615	96	151	2,120	446	2,566	14,883
1970	2,089	631	9,853	116	12,689	(8,537)	4,152	24,082
1971	1,600	561	91	65	2,318	926	3,244	18,815
1972	820	459	123	155	1,558	274	1,832	10,626
1973	1,552	390	116	88	2,146	412	2,558	14,836
1974	1,311	369	226	86	1,994	309	2,303	13,357
1975	677	340	173	128	1,318	1,029	2,347	13,613
1976	489	466	68	63	1,085	1,269	2,354	13,653
1977	770	365	160	109	1,404	823	2,227	12,917
1978	707	367	200	73	1,347	1,441	2,788	16,170
1979	1,491	368	239	108	2,206	1,374	3,580	20,764
TOTAL						(200)		

TABLE V-8

U.S. INDUSTRY
NATURAL GAS ADDITIONS TO ULTIMTE RECOVERY
(BCF) & (10^{12} BTU)

Year	Revisions	Extensions	New Fields	New Reservoirs in Old Fields	Total	Prudhoe Bay Adjustment	Adjusted Total BCF	Adjusted Total 10^{12} BTU
1959		14,852		5,769	20,621		20,621	21,343
1960		7,293		6,601	13,894		13,894	14,380
1961		10,259		6,908	17,166		17,166	17,767
1962		13,185		6,299	19,484		19,484	20,166
1963		12,587		5,578	18,165		18,165	18,801
1964		13,343		6,909	20,252		20,252	20,961
1965		14,776		6,544	21,319		21,319	22,065
1966	4,398	9,225	2,947	3,110	20,220		20,220	20,928
1967	6,571	9,539	3,171	2,525	21,804		21,804	22,567
1968	3,016	7,759	1,376	1,546	13,697	95	13,792	14,275
1969	(1,238)	5,800	1,770	2,043	8,375	1,234	9,609	9,945
1970	(100)	6,158	27,770	3,368	37,196	(23,058)	14,138	14,633
1971	(1,227)	6,375	1,318	3,361	9,825	2,562	12,387	12,821
1972	(1,078)	6,154	1,463	3,096	9,635	759	10,394	10,758
1973	(3,475)	6,177	2,152	1,970	6,825	1,139	7,964	8,243
1974	(1,333)	5,847	2,014	2,151	8,679	854	9,533	9,867
1975	383	6,027	2,423	1,649	10,439	2,847	13,286	13,751
1976	(1,197)	5,337	1,421	1,994	7,555	3,511	11,066	11,453
1977	984	6,601	2,115	2,153	11,852	2,277	14,129	14,624
1978	118	6,733	1,720	2,014	10,586	3,985	14,571	15,081
1979	2,908	7,113	2,576	1,689	14,286	3,792	18,078	18,711
						0		

TABLE V-9

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
NONASSOCIATED NATURAL GAS AND LEASE CONDENSATE
ADDITIONS TO ULTIMATE RECOVERY

	Nonassociated Natural Gas (BCF)			*Lease Condensate at 8.4B MMCF (MMB)*
Year	*Revisions*	*Extensions New Fields and New Reservoirs*	*Total*	(1)
1959			14,744	124
1960			11,134	94
1961			14,724	124
1962			17,552	147
1963			12,947	109
1964			17,059	143
1965			18,246	153
1966	3,502	13,534	17,036	143
1967	4,032	13,931	17,963	151
1968	4,839	9,140	13,979	117
1969	(1,460)	8,315	6,855	58
1970	(301)	9,641	9,340	78
1971	(1,119)	10,037	8,918	75
1972	(1,696)	9,508	7,812	66
1973	(5,321)	9,310	3,989	34
1974	(1,831)	8,868	7,037	59
1975	1,051	9,320	10,371	87
1976	(439)	7,898	7,459	63
1977	(402)	9,853	9,451	79
1978	2,645	9,620	12,265	103
1979	1,140	10,445	11,585	97

(1) An estimate prepared for this study.

Table 10 and Graph 1 show the relationship between the size of the reinvestment programs and the additions to ultimate recovery of hydrocarbons recorded each year. This reinvestment cost index varied between $0.63 and $1.38 and averaged $0.84 per barrel C.O.E. over the 1959-1971 period. Since 1971, this index has increased from $0.87 to $4.07 per barrel C.O.E. by 1978.

It should be remembered that this reinvestment cost index ignores the various time delays between exploration and development investments and the recording of ultimate recovery volumes. Unit finding and development costs, which properly relate specific investments with the ultimate recovery volumes resulting from those investments, have been derived in the reports entitled "Economics of Domestic Crude Oil and Natural Gas Exploration and Development." These reports were published December 1977, September 1978, and June 1979.

TABLE V-10

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES REINVESTMENT RATIOS

Year	*Reinvestment (MMS)*	*Total Additions to Ultimate Recovery (MMB C.O.E.)*	*Reinvestment $ BBL C.O.E. Additions*[2]
1959	4,729	7,471	.633
1960	4,544	4,938	.920
1961	4,373	5,845	.748
1962	5,046	5,805	.869
1963	4,326	5,525	.783
1964	4,775	6,422	.744
1965	4,579	7,005	.654
1966	5,022	6,715	.748
1967	5,345	7,004	.763
1968	6,232	5,067	1.230
1969	5,984	4,339	1.379
1970	5,838	6,753	.865
1971	4,798	5,529	.868
1972	7,631	3,753	2.033
1973	8,901	4,013	2.218
1974	13,116	4,063	3.228
1975	12,929	4,805	2.691
1976	15,535	4,392	3.537
1977	17,877	4,827	3.704
1978	22,323	5,491	4.065

(1) Excluding drilling work in progress adjustment.
(2) 65,591 ÷ 78,418 = 0.84 (1959-1971).

Cash Flow

Table 1 shows the calculation of net cash flow, expressed as cash income after tax less capital expenditures — as adjusted for the drilling costs in progress amounts — and less working capital additions. Working capital additions are discussed in Chapter VIII.

The two right hand columns of Table 1 show the estimates of "surplus cash" after the further deduction of an assumed dividend allocation. The dividend allocation, as a percent of net income, was taken as 50 percent during 1959-72; 40 percent during 1973; and 30 percent after 1973. These dividend payout ratios are based upon a group of predominately domestic integrated petroleum companies. It is not known what the dividend payments would have been, or should have been if the oil and gas field

TABLE VI-1

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES CASH FLOW
MM$

Year	Cash Income After Tax	Capital Expend.	Drilling Cost in Progress Adj.	Increase in Working Capital	Net Cash Flow	Dividends Based Upon Net Income	Surplus Cash
1959	4,224	3,226		9	989	898	91
1960	4,326	3,032		17	1,277	946	331
1961	4,416	2,816		18	1,582	987	595
1962	4,698	3,420		19	1,259	1,037	222
1963	4,849	2,711		5	2,133	1,113	1,020
1964	4,920	3,072		13	1,835	1,097	738
1965	5,050	2,875		38	2,137	1,124	1,013
1966	5,364	3,288		43	2,033	1,249	784
1967	5,892	3,606		34	2,252	1,432	820
1968	6,121	4,431		46	1,644	1,430	214
1969	6,549	4,105		52	2,392	1,547	845
1970	6,415	4,045		43	2,327	1,619	708
1971	6,709	2,966		5	3,738	1,811	1,927
1972	6,879	5,615		104	1,160	1,773	(613)
1973	7,779	6,695	203	510	371	1,708	(1,337)
1974	12,179	9,998	272	195	1,714	2,412	(698)
1975	12,300	9,068	486	187	2,559	2,079	480
1976	14,331	11,813	772	291	1,455	2,341	(886)
1977	17,255	13,343	730	247	2,935	2,709	226
1978	20,305	16,506	1,188	374	2,237	2,792	(555)

(1) 0.664 portion.
(2) 50% during 1959-1972.
40% during 1973.
30% after 1973.
(3) $ 9,308 million 1959-1971.
($3,383 million) 1972-1978.

activities had indeed been carried out on a separate establishment basis. However, the dividend allocations shown on Table 1, while illustrative only, are believed to be generally reasonable.

Surplus cash has totaled $9.3 billion during the 1959-1971 period, but has been negative $3.4 billion during the 1972-1978 period. This is partially because large OCS lease acquisition expenditures during this interval have been based upon a future wellhead price expectancy, which of course had not impacted fully on the annual cash flow during the lease acquisition period (see Table V-1).

The overall surplus cash situation over the twenty year review period indicates that the U.S. industry oil and gas field activities should not be charged any interest expense. However, during the post-1971 period, some borrowing — or liquidation of past surplus cash accumulations — would have been required.

Chapter VII

Write-Offs and Net Income

A. *Net Fixed Assets at 12/31/58*

Table 1 has been prepared to explain the reasonableness of accepting the $14 billion Chase Bank estimate of oil and gas field net fixed assets at 12/31/58 — the start of the review period. The subdivisions of the $14 billion of net assets into the four categories is an estimate for this study. As will be explained later, it is really not necessary to differentiate between tangibles and intangibles.

TABLE VII-1

U.S. INDUSTRY
OIL & GAS FIELD FIXED ASSETS AT 12/31/58
MISCELLANEOUS CORRELATIVE DATA

Hydrocarbon Reserves at 12/31/58		
Crude Oil & Lease Condensate	(MMB)	32,030
Natural Gas	(BCF)	252,403
Total Lease Hydrocarbons	(10^{12} BTU)	447,001
	(MMB COE)	77,069
Capital Expenditures 1949-1958	(MM$)	
Leaseholds		3,693
Drilling and Development[1]		28,172
		31,865
Gross Fixed Assets at 12/31/58	(MM$)	29,400
Net Fixed Assets at 12/31/58	(MM$)	
Non Producing Leases		1,000
Producing Properties		1,500
Intangible Development		5,250
Tangible Development and Equipment		6,250
TOTAL		14,000
Net Fixed Assets at 12/31/58 Related to the Following:		
Crude Oil & Lease Cond. Reserves ($/B)		.44
Total Lease Hydrocarbons ($/BBL COE)		.18
Capital Expenditures (1949-1958)		.44
Gross Fixed Assets at 12/31/58		.48

[1] Includes $7,299MM dry holes.

B. *Capital Expenditures According to Asset Category*

Table 2 shows the subdivisions of capital expenditures into the various asset classifications. The data follow from Tables IV-6, IV-8, IV-11, and V-1. The subdivisions of dry holes into the exploratory and development

categories were obtained by using a long term regression analysis which indicated that 19.6 percent of development drilling (Column 2, Table V-1), during the period 1959-1977, should be classed as dry. For 1978, JAS-Section 1, actually reported the development dry hole cost amount which was 18.5 percent of development drilling.

TABLE VII-2

U.S. INDUSTRY
CAPITAL EXPENDITURES OR ADDITIONS
ACCORDING TO OIL AND GAS FIELD ASSET CLASSIFICATION
(MM$)

Year	*Devel. Dry Holes*	*Non-Producing Leases*	*Transfers to Producing Leases*	*Tangible Productive*	*Intangible Productive*
1959	359	554	134	1,032	1,281
1960	324	626	157	907	1,174
1961	318	428	159	913	1,157
1962	339	815	133	1,031	1,236
1963	296	376	93	966	1,074
1964	309	570	89	1,061	1,131
1965	304	438	169	1,046	1,086
1966	305	577	148	1,272	1,135
1967	289	829	228	1,354	1,134
1968	302	1,578	187	1,365	1,186
1969	320	1,137	199	1,336	1,312
1970	340	1,102	93	1,310	1,294
1971	308	254	137	1,235	1,168
1972	366	2,474	182	1,400	1,375
1973	395	3,306	459	1,493	1,501
1974	526	5,247	259	2,190	2,035
1975	830	1,679	381	3,381	3,178
1976	988	3,024	301	4,199	3,602
1977	1,338	2,587	634	4,587	4,831
1978	1,632	2,912	629	5,663	6,299
UNRECOVERED COST AT 12/31/58	2,000	1,000	1,500	6,250	5,250

C. *Unit of Production Write-Off Rates*

U.O.P. write-off rates are expressed as the ratio of the annual provision during each year to the net assets at the start of that year plus 50 percent of the additions to the account during that year. Hydrocarbon production rates are similarly expressed as the ratio of the annual production during each year to the reserve volumes at the start of the annual production during each year plus 50 percent of the additions to ultimate recovery recorded during that year.

If all assets were in one USA total aggregation, the write-off and production rates would be the same. However, in the earlier part of the review period, higher cost assets were produced at higher rates, principally because of depth factors or offshore multipliers in the crude oil production proration formulae. Thereafter, production proration restrictions were

gradually relaxed from most severe during 1962 to 100 percent market demand factors during 1973. After 1972, there should be a greater tendency for all wells to produce at similar percentage rates regardless of cost.

A review of write-off rate and production rate comparisons for situations believed to be typical has been carried out. In the case of tangible and intangible equipment, it was indicated that write-off rates should average 125 percent of production rates during 1959-1962. This "multiplier" was assumed to decline to 100 percent by 1972 and to remain so thereafter. This adjustment is believed generally appropriate for establishments which calculate write-offs at the field aggregation level. This estimated multiplier is shown by the fifth column of Table 4.

The U.O.P. write-off rate for producing properties has generally been about two-thirds of the write-off rate for tangible-intangible assets. This is believed to be partially because of the use of proved rather than developed reserves as the basis for determining U.O.P. rates. Also, investment is not being continually added to individual lease hold accounts, so the older leases should be fairly well written down. Most of the proved but undevel-

TABLE VII-3

INDUSTRY USA
HYDROCARBON PRODUCTION RATES

	USA		*Gulf of Mexico*	
Year	*Crude Oil*	*Nonassoc Natural Gas*	*Crude Oil*	*Nonassoc Natural Gas*
1959	.077	.046		
1960	.075	.048		
1961	.077	.049		
1962	.078	.048		
1963	.080	.051		
1964	.082	.053		
1965	.083	.056		
1966	.087	.058		
1967	.092	.060	.109	.045
1968	.096	.064	.119	.054
1969	.101	.071	.121	.068
1970	.106	.079	.123	.075
1971	.107	.082	.130	.086
1972	.112	.090	.142	.085
1973	.115	.095	.147	.102
1974	.114	.097	.146	.106
1975	.114	.094	.136	.107
1976	.119	.097	.135	.105
1977	.123	.102	.139	.112
1978	.126	.106	.140	.126

(1) Annual production as a portion of proved reserves at start of year plus 50% of additions during year.
(2) Excludes North Alaska.

oped reserves are probably concentrated in the younger leases which have higher unrecovered costs.

Table 3 shows hydrocarbon production rates for the US industry.

D. *Write-Offs*

For ease in modeling and to increase the reasonableness of write-off rates, the tangible, intangible, and dry development well assets have been combined into one account. The write-off calculations are summarized on Table 4. An unrecovered asset amount of $2 billion at 12/31/58 has been added to the $14 billion amount indicated by Table 1, so as to provide for capitalization of development dry holes on a retroactive basis. It is estimated that about $6 billion of the net asset balance at 12/31/78, shown in Table 4, is in the category of development dry holes.

TABLE VII-4

INDUSTRY USA
OIL AND GAS FIELDS
TANGIBLE AND INTANGIBLE ACCOUNTS
MM$

Year	*Additions*	*Depreciation and Amortization*	*Net Asset Balance at 12/31*	*Prod. Rate Crude Oil*	*Multiplier*	*Depr. & Amort. Rate*	*Depr. & Amort. Rate Rounded*
1958			13,500				
1959	2,672	1,484	14,688	.077	1.250	.096	.10
1960	2,405	1,589	15,504	.075	1.250	.094	.10
1961	2,388	1,670	16,222	.077	1.250	.096	.10
1962	2,606	1,753	17,075	.078	1.250	.098	.10
1963	2,336	1,824	17,587	.080	1.225	.098	.10
1964	2,501	1,884	18,204	.082	1.200	.098	.10
1965	2,436	1,942	18,698	.083	1.175	.098	.10
1966	2,712	2,005	19,405	.087	1.150	.100	.10
1967	2,777	2,079	20,103	.092	1.125	.104	.10
1968	2,853	2,368	20,588	.096	1.100	.106	.11
1969	2,968	2,428	21,128	.101	1.075	.109	.11
1970	2,944	2,486	21,586	.106	1.050	.111	.11
1971	2,711	2,524	21,773	.107	1.025	.110	.11
1972	3,141	2,568	22,346	.112	1.000	.112	.11
1973	3,389	2,644	23,091	.115	1.000	.115	.11
1974	4,751	2,801	25,041	.114	1.000	.114	.11
1975	7,389	3,161	29,269	.114	1.000	.114	.11
1976	8,789	4,040	34,018	.119	1.000	.119	.12
1977	10,756	4,728	40,046	.123	1.000	.123	.12
1978	13,594	6,090	47,550	.126	1.000	.126	.13

The write-off calculations for nonproducing leases are summarized on Table 5. Amortization each year was set as 20 percent of the total of surrenders that year and the four following years. The surrender rate during 1979-82 was projected as $2 billion annually.

TABLE VII-5

INDUSTRY USA
OIL AND GAS FIELD ACTIVITIES
NON PRODUCING LEASEHOLD ACCOUNT
MMs

Year	*Additions*	*Transfers to Producing Status*	*Surrenders*	*Amortization*	*Net Asset Balance at 12/31*
1958					1,000
1959	554	134	428	404	1,016
1960	626	157	446	389	1,096
1961	428	159	395	382	983
1962	815	133	380	379	1,286
1963	376	93	369	401	1,168
1964	570	89	357	395	1,254
1965	438	169	408	399	1,124
1966	577	148	380	405	1,148
1967	829	228	489	427	1,322
1968	1,578	187	342	444	2,269
1969	1,137	199	375	480	2,727
1970	1,102	93	439	497	3,239
1971	254	137	490	514	2,842
1972	2,474	182	576	522	4,612
1973	3,306	459	521	596	6,863
1974	5,247	259	459	1,020	10,831
1975	1,679	381	522	1,328	10,801
1976	3,024	301	532	1,624	11,900
1977	2,587	634	946	1,917	11,936
1978	2,912	629	2,640	2,128	12,091

The producing property accounts are summarized on Table 6.

All write-offs are summarized on Table 7, and a simple balance between capital expenditures, write-offs, and net asset balances is presented on Table 8.

TABLE VII-6

INDUSTRY USA
OIL AND GAS FIELD ACTIVITIES
PRODUCING PROPERTY ACCOUNT
MM$

Year	*Additions*	*Depl*	*Net Assets at 12-31*	*Rate*
1958			1,500	
1959	134	110	1,524	.070
1960	157	112	1,569	.070
1961	159	115	1,613	.070
1962	133	118	1,628	.070
1963	93	117	1,604	.070
1964	89	115	1,578	.070
1965	169	116	1,631	.070
1966	148	119	1,660	.070
1967	228	124	1,764	.070
1968	187	139	1,812	.075
1969	199	143	1,868	.075
1970	93	144	1,817	.075
1971	137	141	1,813	.075
1972	182	143	1,852	.075
1973	459	156	2,155	.075
1974	259	171	2,243	.075
1975	381	183	2,441	.075
1976	301	207	2,535	.080
1977	634	228	2,941	.080
1978	629	293	3,277	.090

TABLE VII-7

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
WRITE OFF SUMMARY
(MM$)

Year	Amort. Non Producing Leases	Depl. Producing Leases	Amort. & Depr. Decel. Capital	Total
1959	404	110	1,484	1,998
1960	389	112	1,589	2,090
1961	382	115	1,670	2,167
1962	379	118	1,753	2,250
1963	401	117	1,824	2,342
1964	395	115	1,884	2,394
1965	399	116	1,942	2,457
1966	405	119	2,005	2,529
1967	427	124	2,079	2,630
1968	444	139	2,368	2,951
1969	480	143	2,428	3,051
1970	497	144	2,486	3,127
1971	514	141	2,524	3,179
1972	522	143	2,568	3,233
1973	596	156	2,644	3,396
1974	1,020	171	2,801	3,992
1975	1,328	183	3,161	4,672
1976	1,624	207	4,040	5,871
1977	1,917	228	4,728	6,873
1978	2,128	293	6,090	8,511

E. *Bureau of Census Data*

The Bureau of Census has reported net assets for oil and gas field activities as $61.9 billion at the end of 1978, while the amount of this study is $62.9 billion. However, there are several reasons why the Census net investment amounts are not comparable to those of this study.

The Bureau of Census net assets include $4.9 billion for work in progress, while the procedures of this study wait until well completion before further processing of work in progress. About 20 percent of oil and gas field revenues are received by establishments which use full cost accounting methods or methods other than the successful efforts procedures utilized in

this study. Accordingly, the Census net investments would include some assets which would have been charged directly to expense or written off in this study. Also there have probably been significant increases in net asset values in the Census figures because of transfer of assets between establishments with concurrent increase in book value (these transfers are ignored in this study). Finally, it is apparent that approximately 30 percent of the well completions and probably 20-25 percent of the historic drilling costs have always been outside of the Census data system. Uncertainty of this magnitude essentially destroys the utility of those Census data which include drilling expenditures.

TABLE VII-8

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
CAPITAL EXPENDITURES — WRITE OFFS
— NET ASSETS BALANCES
MM$

Year	*Capital Expenditure*	*Write Offs*	*Net Assets at 12-31*
1958			16,000
1959	3,226	1,998	17,228
1960	3,032	2,090	18,169
1961	2,816	2,167	18,818
1962	3,420	2,250	19,989
1963	2,711	2,342	20,359
1964	3,072	2,394	21,036
1965	2,875	2,457	21,453
1966	3,288	2,529	22,213
1967	3,606	2,630	23,189
1968	4,431	2,951	24,669
1969	4,105	3,051	25,723
1970	4,045	3,127	26,642
1971	2,966	3,179	26,428
1972	5,615	3,233	28,810
1973	6,695	3,396	32,109
1974	9,998	3,992	38,115
1975	9,068	4,672	42,511
1976	11,813	5,871	48,453
1977	13,343	6,873	54,923
1978	16,506	8,511	62,918

F. Chase Manhattan Bank Data

Table 9 summarizes U.S. oil and gas field capital expenditures as reported by Chase Manhattan Bank. The total capital expenditures, including all dry holes, as reported by Chase Bank over the review period range around 95 percent of the amounts listed in this study. The Chase Bank dry hole capital expenditures include all dry holes because none are included within the Bank's exploration expense category. Table 10 presents a simple balance between the Chase Bank capital expenditures, apparent write-offs, and net asset balances. The net asset balances at year end, as reported by the Bank, are less than those of this study by about two billion dollars at the

TABLE VII-9

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
CAPITAL EXPENDITURES
PER CHASE BANK
(MMS)

Year	*Onshore Leases*	*Offshore Leases*	*Producing Wells & Equipment*	*Dry Holes*	*Total*
1959					3,700
1960					3,575
1961					3,400
1962					3,850
1963	575	-	2,125	825	3,525
1964	475	175	2,225	925	3,800
1965	400	100	2,200	900	3,600
1966	300	260	2,115	925	3,600
1967	300	560	2,040	850	3,750
1968	300	1,375	2,150	850	4,675
1969	1,125	125	2,325	950	4,525
1970	150	950	2,160	850	4,110
1971	200	100	2,095	790	3,185
1972	200	2,275	2,330	935	5,740
1973	500	3,100	2,705	985	7,290
1974	700	5,100	3,975	1,450	11,225
1975	500	1,200	5,515	1,840	9,055
1976	600	2,275	8,055	2,205	13,135
1977	650	1,675	9,645	2,885	14,855
1978	700	1,850	10,875	3,900	17,325

(1) Includes both exploration and development.

end of 1958 and by about six billion dollars at the end of 1976. This is believed to be principally caused by the development dry holes which are capitalized and depreciated in this study and which are apparently written off immediately in the Chase Bank reportings.

It has not been possible to explain the apparent anomaly in the Chase Bank 1977 data on Table 10. They also publish data similar to Tables 9 and 10 for a group of petroleum companies which make up about two-thirds of the total U.S.A. oil and gas field activity sector. These latter reports do not indicate any data hiatus such as that on Table 10 in 1977.

TABLE VII-10

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
CAPITAL EXPENDITURES – WRITE OFFS
– NET ASSETS BALANCES
PER CHASE BANK
(MMs)

Year	*Capital Expenditure*	*Write Offs (Inferred)*	*Net Assets at 12-31*
1958			14,000
1959	3,700	2,850	14,850
1960	3,575	2,700	15,725
1961	3,400	2,400	16,725
1962	3,850	2,725	17,850
1963	3,525	2,800	18,575
1964	3,800	2,650	19,725
1965	3,600	2,700	20,625
1966	3,600	2,850	21,375
1967	3,750	2,775	22,350
1968	4,675	3,350	23,675
1969	4,525	3,400	24,800
1970	4,110	3,815	25,095
1971	3,185	3,900	24,380
1972	5,740	4,070	26,050
1973	7,290	4,465	28,875
1974	11,225	5,375	34,725
1975	9,055	7,495	36,285
1976	13,135	7,000	42,340
1977	14,855	1,025(?)	56,170(?)
1978	17,325	10,264	63,261

(1) Includes dry holes during year of drilling.

(2) Reduced 4-5% during 1959-1964 to exclude gas processing assets.

G. *Interperiod Tax Allocations Associated With Write-Offs*

Tax allocations have been estimated on account of different write-off procedures between tax and corporate books for dry holes, nonproducing leases, geological and geophysical expenses, intangible development, and productive tangible assets — on a total basis. The calculations are summarized on Table 11.

TABLE VII-11

U.S INDUSTRY
OIL AND GAS FIELD ACTIVITIES
INTERPERIOD TAX ALLOCATIONS ASSOCIATED WITH WRITE-OFFS
(MM$)

Year	*Tax Write-Offs*	*Book Write-Offs*	*Difference*	*Tax Rate*	*Deferred Taxes*
1959	2,717	1,888	829	.52	431
1960	2,640	1,978	662	.52	344
1961	2,583	2,052	531	.52	276
1962	2,851	2,132	719	.52	374
1963	2,767	2,225	542	.52	282
1964	2,945	2,279	666	.50	333
1965	3,061	2,341	720	.48	346
1966	3,114	2,410	704	.48	338
1967	3,336	2,506	830	.48	398
1968	3,399	2,812	587	.528	310
1969	2,675	2,908	767	.528	405
1970	3,086	2,983	103	.492	51
1971	2,849	3,038	(189)	.48	(91)
1972	3,298	3,090	208	.48	100
1973	3,476	3,240	236	.48	113
1974	4,130	3,821	309	.48	148
1975	5,345	4,489	1,456	.48	698
1976	7,033	5,664	1,369	.48	657
1977	9,461	6,645	2,816	.48	1,352
1978	13,402	8,218	5,184	.48	2,488

(1) Associated with nonproducing leases, development dry holes, depreciation, intangible development, reduced by capitalized G&G adjustment.

(2) Associated with nonproducing leases, tangible, intangibles, and development dry holes.

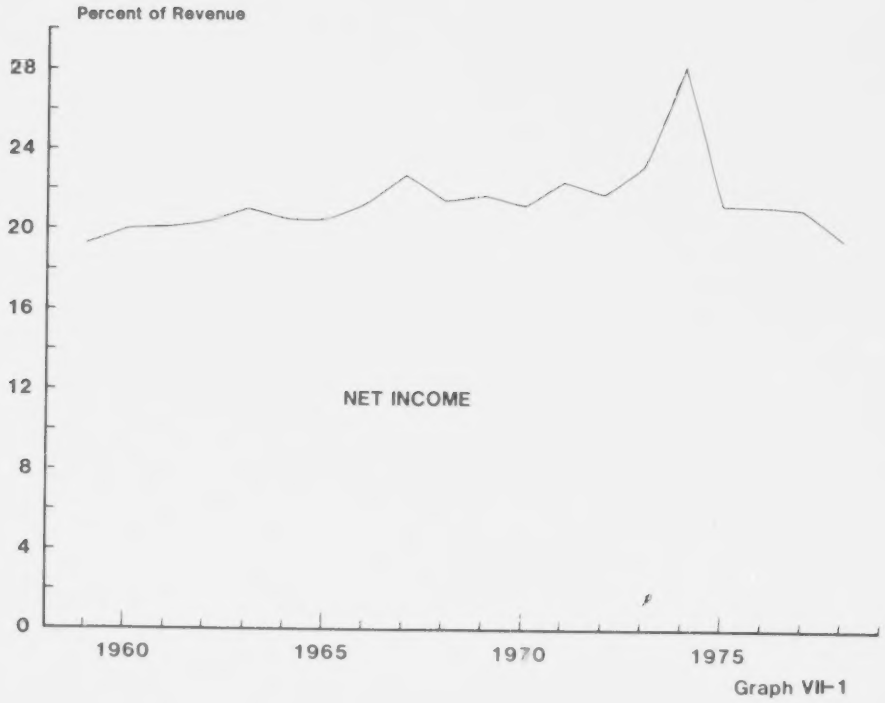
H. *Net Income*

Net income for the US crude oil and natural gas field activities is summarized on Table 12. Net income has increased from $1.8 billion during 1959 to $3.6 billion during 1971-72 and then to $9.3 billion by 1978. Graph 1 shows that net income as a percent of revenue has averaged about 21 percent except during 1973-74.

TABLE VII-12

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES NET INCOME
(MM$)

Year	*Cash Income After Tax*	*Write Offs*	*Deferred Taxes*	*Net Income*
1959	4,224	1,998	431	1,795
1960	4,326	2,090	344	1,892
1961	4,416	2,167	276	1,973
1962	4,698	2,250	374	2,074
1963	4,849	2,342	282	2,225
1964	4,920	2,394	333	2,193
1965	5,050	2,457	346	2,247
1966	5,364	2,529	338	2,497
1967	5,892	2,630	398	2,864
1968	6,121	2,951	310	2,860
1969	6,549	3,051	405	3,093
1970	6,415	3,127	51	3,237
1971	6,709	3,179	(91)	3,621
1972	6,879	3,233	100	3,546
1973	7,779	3,396	113	4,270
1974	12,179	3,992	148	8,039
1975	12,300	4,672	698	6,930
1976	14,331	5,871	657	7,803
1977	17,255	6,873	1,352	9,030
1978	20,305	8,511	2,488	9,306



Graph VII-1

Return on Net Investment

For the industry study, working capital at the start of each year has been presumed to grow with the scale of operations and has been assumed as 5 percent of the value of oil and gas revenue before royalty during each year.

Table 1 shows the calculation of net income as a percent of net investment at the start of the year for US industry oil and gas field activities. The return was in the 10-11 percent range during 1959-1966; in the 12-13 percent range during 1967-1972; 14 percent during 1973; 24 percent during 1974; and in the 15-17 percent range thereafter.

The data from Table 1 are included on a graph in Chapter I (Graph I-4).

Table 2 shows rates of return from selected sources. The first three columns of Table 2 indicate that petroleum industry returns, as reported worldwide by Citibank and the Chase Manhattan Bank, have generally been similar to or somewhat less than the Citibank "all manufacturing"

TABLE VIII-1

U.S. INDUSTRY
OIL AND GAS FIELD ACTIVITIES
RETURN ON NET INVESTMENT

	Net Investment at January 1 (MMS)					
Year	*Fixed Assets*	*Working Capital*	*Cum. Drlg. Work in Progress Adjustment*	*Total*	*Net Income (MMS)*	*Percent Return on Net Investment*
1959	16,000	452		16,452	1,795	10.9
1960	17,228	461		17,689	1,892	10.7
1961	18,169	478		18,647	1,973	10.6
1962	18,818	496		19,314	2,074	10.7
1963	19,989	515		20,485	2,225	10.9
1964	20,359	520		20,879	2,193	10.5
1965	21,036	533		21,569	2,247	10.4
1966	21,453	571		22,024	2,497	11.3
1967	22,213	614		22,827	2,864	12.5
1968	23,189	648		22,837	2,860	12.5
1969	24,669	694		25,363	3,093	12.2
1970	25,723	746		26,469	3,237	12.2
1971	26,642	789		27,431	3,621	13.2
1972	26,428	794		27,222	3,546	13.0
1973	28,810	898		29,708	4,270	14.4
1974	32,109	1,408	305	33,832	8,039	23.8
1975	38,115	1,603	714	40,432	6,930	17.1
1976	42,511	1,790	1,445	45,747	7,803	17.1
1977	48,543	2,081	2,609	53,233	9,030	17.0
1978	54,923	2,328	3,708	60,959	9,306	15.3
1979	62,918	3,096	5,497	71,511		

reportings. An important exception is the relatively high petroleum industry return during 1974.

A comparison of the sixth column with Columns 2, 3, and 4, indicates that industry's return from oil and gas field activities has generally exceeded that from all petroleum operations, except during 1963-67. (See Graph I-4.)

TABLE VIII-2

RATES OF RETURN
FROM SELECTED SOURCES
(%)

	Citibank		*Chase Bank Group*			*USA*
Year	*Total Mfg.*	*Petroleum Prod. & Rfg.*	*World*	*USA*	*Foreign*	*Oil and Gas Field Activities*
1959	11.7	10.0	9.7			10.9
1960	10.6	10.3	10.0			10.7
1961	9.9	10.4	10.0			10.6
1962	10.9	10.6	10.3			10.7
1963	11.6	11.5	11.2			10.9
1964	12.7	11.6	11.1			10.5
1965	13.9	11.9	10.8	11.2	10.2	10.4
1966	14.2	12.6	11.3	12.3	9.9	11.3
1967	12.6	12.8	11.5	12.6	10.1	12.5
1968	13.3	13.1	11.7	12.3	11.0	12.5
1969	12.4	11.9	11.0	10.9	11.2	12.2
1970	10.8	11.0	10.4	9.9	11.0	12.2
1971	10.8	11.2	10.7	9.3	12.5	13.2
1972	12.1	10.8	9.7	9.6	9.9	13.0
1973	14.9	15.6	15.5	10.5	20.9	14.4
1974	15.2	19.6	19.2	14.6	23.9	23.8
1975	12.6	13.9	12.8	12.9	12.7	17.1
1976	15.0	14.8	13.8	15.2	12.3	17.1
1977	14.9	14.0	13.8	14.2	13.4	17.0
1978	15.9	14.5	13.2	13.8	12.5	15.3

(1)Net income as percent of net worth.
(2)Net income as percent of average invested capital.
(3)Net income as percent of net fixed assets plus working capital at start of year.

Chapter IX

Inflation

A. *General*

The historical cost financial statements included in this report record dollars received or expended each year without regard to the changes of purchasing power of the currency. Actual inflation, as measured by the Gross National Product implicit price deflator series, during the review period may be summarized as below:

Period	*Inflation Rate (% PA)*
1958-63	1.4
1963-68	2.8
1968-73	5.1
1973-78	7.5
1958-78	4.2

It is beyond the scope of this report to develop the vintaged financial and volume accounts necessary to permit restating write-offs, net income, net investment, and percent return on net investment on a constant dollar basis. However, it does appear possible to restate some of the operating indexes and unit investment cost indexes, as well as the cash flow analysis, on a 1979 constant dollar basis. This permits viewing the financial data in terms of a common unit of measurement. Also the adjustment for inflation permits a separation of the escalations of these indexes or amounts into those portions caused by — or compatible with — debasement of the monetary unit and those portions caused by the combined effects of all other factors.

Generally, it has been observed that the impacts of inflation, as well as the impacts of the other — or technical — factors were moderate during the first three quarters of the review period. During the most recent five years, the impacts of both inflation and the remaining technical factors were each considerable. In this brief discussion, average annual percentage growth rates of various indexes or financial amounts, measured on a current dollar basis, will be compared with growth rates measured on a constant dollar basis. The escalations assignable to inflation or to the other technical factors are thus indicated.

B. *Operating Indexes*

The table below shows average annual percentage growth rates for wellhead values and some operating indexes, across diagnostic time periods, and as measured on a current dollar or on a 1979 constant dollar basis. It may be seen that during the first three quarters of the review period, the adjustment to remove the effects of inflation generally transformed moderate growth rates into moderate decline rates. During the most recent five years, it is also indicated that from 50-70 percent of the much higher

growth rates, as measured in terms of current dollars, still remain after the adjustments to remove inflation.

OPERATING INDEXES — GROWTH RATES

Time Period	*Crude Oil Value $ BBL*	*Natural Gas Value $ MCF*	*Production Operating Costs $ BBL. C.O.E.*	*Production Overhead $ BBL. C.O.E.*	*Operating Cash Income $ BBL. C.O.E.*
Growth Rates (% PA) — Current Dollar Indexes					
1959-73	2.1	3.7	1.5	0.8	1.8
1973-78	18.2	33.2	20.9	19.3	24.3
1959-78	6.1	10.8	6.3	5.3	7.3
Growth Rates (% PA) — 1979 Constant Dollar Indexes					
1959-73	(1.0)	0.6	(1.6)	(2.5)	(1.3)
1973-78	9.8	23.8	12.4	10.9	15.5
1959-78	1.7	6.2	1.9	1.0	2.9

The growth rates for the various indexes — as listed on the lower part of the above table — show the combined effects of all other factors except inflation. The list of these technical factors would include the following: more rigorous environments, greater complexity, gradual maturity, increasing per well production rates through 1972, declining per well production rates after 1972, and improving technology. Finally, the increasing wellhead values themselves have commercialized less attractive opportunities having higher costs; they have justified increased remedial work and more complex production methods to maintain maximum production rates; they have justified keeping high production cost wells on active status; and they have led to higher fuel costs. Also, the additional activity has taxed available manpower and equipment so as to cause oil country inflation to exceed the general rate.

C. *Reinvestment Program Cost Indexes*

Reinvestment program costs per barrel COE of additions to ultimate recovery did not change significantly over the first thirteen years of the analysis period 1959-1971 (see Graph V-1). They averaged $0.84 per barrel COE on a current dollar basis and $1.79 per barrel COE on a 1979 constant dollar basis. The trend of the annual indexes during the 1959-1971 period appears very slightly upward on a current dollar basis and very slightly downward on a constant dollar basis.

In 1972, the index increased about 130 percent over the 1971 value. Between 1972 and 1978, the reinvestment program cost indexes grew 12.3 percent annually on a current dollar basis and 4.7 percent annually on a constant dollar basis.

The reinvestment program indexes, which do not adjust for the lead time

between expenditures and new reserve volume recognition, are in a difficult-to-analyze transition stage during 1972-1978. This is because of the extreme surge in OCS lease bonus expenditures which commenced in 1972; have continued since 1972; and are too recent to have resulted in any significant new reserve volumes thus far in the review period (see Graph I-3).

Finally, it should be remembered that investment opportunity selection by prudent operators is based upon future wellhead price expectations which should increase faster than the general inflation rate in the near term future. These future expectations, in turn, have commercialized less attractive opportunities which should result in unit investment cost escalations exceeding the inflation rate.

D. *Cash Flow Analysis*

The cash flow analysis is influenced by all of the factors discussed above as well as by changes in total annual production levels, changes in reinvestment ratios, and by changes in income tax regulations (see Graph I-1, Graph V-1, and Graph IV-1).

The table below lists average annual percentage growth rates of the elements of cash flow across diagnostic time periods, and as measured on a current dollar basis or on a 1979 constant dollar basis.

ELEMENTS OF CASH FLOW
GROWTH RATES

Time Period	*Revenue*	*Total Production Operating Costs*	*Reinvestment Program & ΔWC*	*Income Taxes*	*Allocated Dividends*
Growth Rates (% PA) — Current Dollar Basis					
1959-73	3.6	3.5	3.8	—	4.7
1973-78	21.2	19.6	20.0	26.6	10.3
1959-78	9.0	8.5	8.8	—	6.2
Growth Rates (% PA) — 1979 Constant Dollar Basis					
1959-73	1.3	1.2	1.4	—	1.5
1973-78	12.6	11.3	11.5	17.8	2.6
1959-78	4.5	4.0	4.4	—	1.8

The growth rates measured on a constant dollar basis are very moderate during the 1959-1973 period and less than half the 3.3 percent PA growth rate recorded for production during this period.

After 1973, the various cash flow elements grew more steeply. The adjustments to remove the effects of inflation suppressed only 40 percent of the growth, as measured by the current dollar indexes, and dividend pay out ratios were reduced.

Net cash flow during the twenty years amounts to $69.5 billion (1979 $

basis) as compared to $38.0 billion (current $ basis). The surplus cash comparisons are shown below:

SURPLUS CASH (BILLIONS OF $)

Time Period	*1979 Constant $*	*Current $*
1959-71	19.2	9.3
1972-78	(4.9)	(3.4)
1959-78	14.3	5.9

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Abbreviations

Numerous abbreviations have been used throughout the analysis. Many of these are necessary because of space limitations on tables and graphs. Others appear in the text after the unabbreviated word or phrase is first mentioned. Some of the abbreviations are obvious or commonplace. However, in order to avoid confusion, all of the abbreviations are listed below:

ad val. tax	ad valorem tax
adj.	adjustment
Al.	Alabama
AAPG	American Association of Petroleum Geologists
AGA	American Gas Association
API	American Petroleum Institute
amort.	amortization
B or bbl.	barrel
BCF	billion cubic feet
BTU	British thermal unit
cont.	contribution
C.O.E.	crude oil equivalent
cum.	cumulative
dept.	department
DOE	Department of Energy
depl.	depletion
depr.	depreciation
devel.	development
DDB	double declining balance
drlg.	drilling
equip.	equipment
ex.	excluding
expend.	expenditure
explor.	exploration
Fl.	Florida
G&A	general and administrative
G&G	geological and geophysical
geol. & geoph.	geological and geophysical
incl.	including
invest.	investment
intang.	intangible
JAS	Joint Association Survey
La.	Louisiana
lse. cond.	lease condensate
M	thousand
MAFLA	Eastern Gulf of Mexico off Mississippi-Alabama-Florida
MCF	thousand cubic feet
min.	minimum
mfg.	manufacturing
MM	million
MMB/D	million barrels per day

MMCF	million cubic feet
nonassoc.	nonassociated
OCI	operating cash income
OCS	outer continental shelf
oper.	operating
ovhd.	overhead
prod.	producing
PA	per annum
R&D	research and development
rev.	revenue
rfg.	refining
roy.	royalty
surr.	surrendered
SYD	sum of year's digits
tang.	tangible
TCF/Y	trillion cubic feet per year
Tx.	Texas
UOP	unit of production
USBM	United States Bureau of Mines
USGS	United States Geological Survey
WIP or work in prog.	work in progress
10^{12}	trillion
ΔW.C.	change in working capital

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